December 30, 1920 American Machinist Vol. 53, No. 27

Production and Salvage of Locomotive Piston Rings

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Western Editor, *American Machinist*

The systematic manner in which locomotive piston rings are cared for as described in this article is well worthy of record. Several devices that have been shop-built for doing this work should help to suggest ideas to other railroad shop-men for caring for their work of similar character.

PISTON rings are a constant source of expense in the upkeep of a locomotive. Not only must they be replaced when the engine comes in for its periodical overhauling, but they must often be replaced as a part of the running repairs in roundhouse work. In the Beech Grove shops of the Big Four railway system, at Indianapolis, piston ring work has led to the development of some remarkable machines both for making up new sets and for salvaging the old.

The recovery of old rings is by no means an unimportant portion of the work of this shop, since it has been found possible by adopting a series of standardized sizes, to use each ring several times by successively reducing its cylinder size. Wear on the rings has been found to be greater on one edge than the other so that the surface is worn off on a sort of bevel but by again truing the periphery in a manner that will be described later, it has been found possible to salvage each ring for re-use.

New rings are turned from cast bushings on vertical boring mills in a manner no different from regular machine-shop practice. In the second machine operation the device shown in Fig. 1 is used for cutting the rings into equal sections so that they may be bundled as shown in Fig. 2 and distributed to all points where new rings are needed.

The cutting saw, shown in Fig. 1, is driven by a belt through a worm gear reduction. The ring is carried on a sliding table *A* that can be fed against the saw by the hand lever *B*. The lever feed is simple since little travel is required and the necessity of a rack feed is therefore eliminated. The lever has a fulcrum in a slotted hole about the pin *C*. The second pin, *D*, provides attachment to the table and carries the latter forward when the lever is raised. The thrust from the saw on the ring is carried by a block *E* bolted to the table.

The details of the mechanism for dividing the ring into equal sections are shown in Fig. 3. The table is inscribed with circles of standard ring diameters which will indicate the size without necessarily measuring. The center *A* for the arm *B* is set in the center of the ring circle and the length of arm approximately regulated so that its bracket stops *C* will reach the inside of the

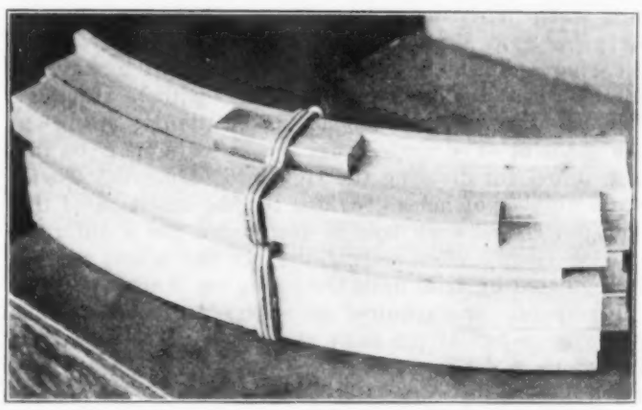


FIG. 2. BUNDLE OF WIRE-BOUND PISTON RING SEGMENTS

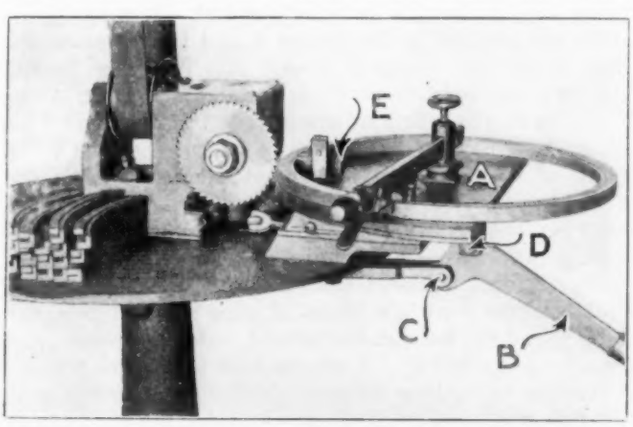


FIG. 1. DEVICE FOR SAWING LOCOMOTIVE PISTON RINGS INTO SEGMENTS

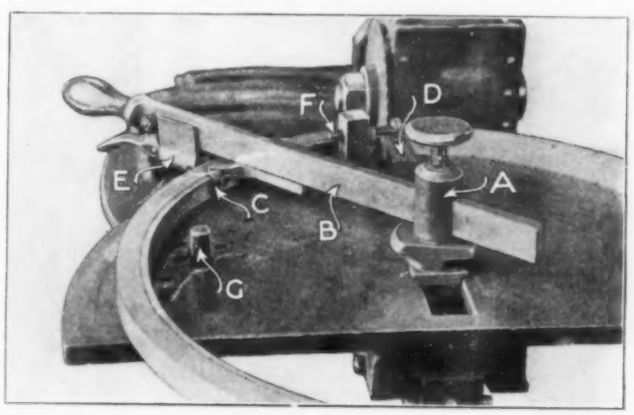


FIG. 3. SEGMENT SPACING DEVICE ON RING SAWING MACHINE

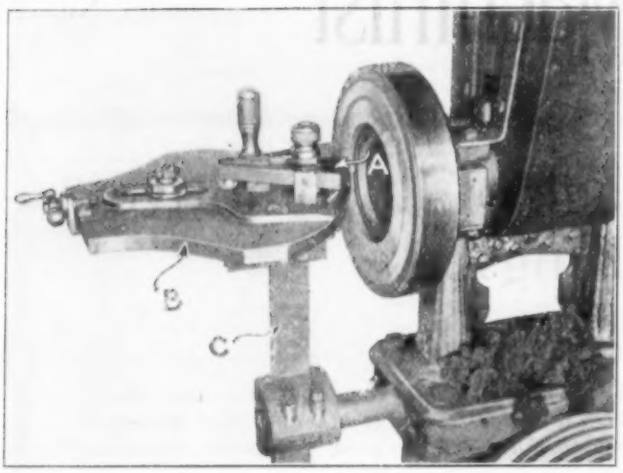


FIG. 4. GRINDING MACHINE FOR SALVAGING WORN PISTON RINGS

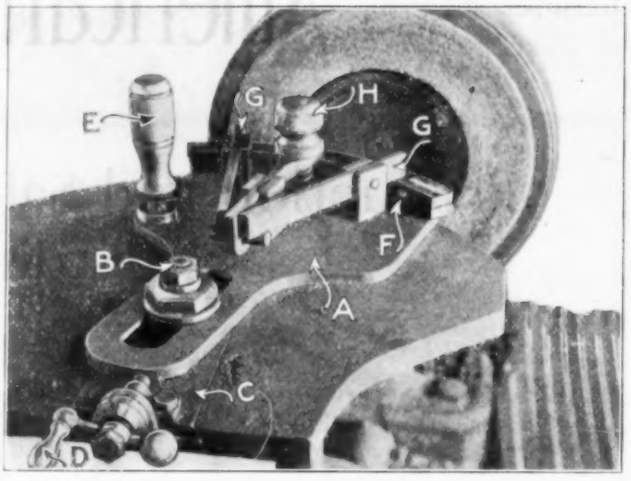


FIG. 5. CLAMPING AND FEEDING MECHANISM OF RING GRINDING FIXTURE

ring when the latter is pressed against the saw stop *D*. A spring grip *E* on the outer end of the handle holds the ring against the stop *C* so that the ring may be rotated about the center *A* of the arm without slipping.

The radius arm *B* is then in a position to swing in the segment of a circle from the screw stop *F* to the stop pin *G* for dividing the ring into segments. There are a number of holes provided for the insertion of the stop pin G and each hole is designated for a different size of ring. After setting the pin the screw stop *F* is regulated by trial until the swinging arm will divide the ring into the required number of equal segments. Since large lots of the same size rings are put through the shop at a time, the time required for setting the machine counts for little when divided among the aggregate amounts.

Worn piston rings are returned from the different repair shops in sets with suitable care exercised so that the component parts of each ring are not lost. Each section of every ring is numbered in sequence and the diameter of the ring is also stamped on its side. The returned sections are taken to the device shown in Fig. 4 for regrinding to the next smaller diameter and thus salvaged in the manner that has been mentioned previously. The section of ring *A* is held clamped in a special fixture on the table. The table *B* is rigidly supported in position by the vertical brace *C* but may be adjusted to or from the wheel as the requirements of supporting the work-fixture may indicate.

The plate *A*, Fig. 5, carrying the clamping fixture has a slotted and graduated arm so that it may be adjusted to swing at different radii about the center pivot *B*. The pivot center is carried on an adjustable slide *C* so that the work (while being rotated at the proper radius) may be set forward to bring it against the wheel until the proper amount of stock has been removed. The feed of the slide *C* is by the handwheel *D*. Graduations on the collar and table indicate when the slide has been fed forward to the zero point, where it swings at the radius required for the ring.

In swinging, the plate *A* slides on the surface of the table and has a sufficiently broad bearing to provide adequate support and prevent rocking. The operator grasps the handle *E* for imparting the swinging action. The work is inserted in the clamping fixture against the pin stops *F* and beneath the clamping arms *G*, and clamping pressure is obtained by screwing down the hand nut *H*. A free cutting grinding wheel is used for removing the material with fair rapidity.

Both new and salvaged sets of ring segments are bundled for handling, as shown in Fig. 2, in the wire wrapping device shown in Fig. 6. The wire wrapping must be so tightly done that there is no danger of segments slipping out to be mixed or lost. A set of segments are stacked in the holder *A* and tightly squeezed together by the clamping screw *B*. The wire is fed from the reel beneath the table through a friction guide *C* and in starting to bind the end is twisted about the screw *B*. The wire reel is a steel affair carried on a couple of shaft hangers, supported from the under side of the table. A friction brake is provided on the reel shaft so that considerable force must be exerted to draw off the wire, thus helping to insure tight binding.

The segment holder *A* can be rotated by the crank *D*. Usually three complete turns of wire are sufficient for the job, and the loose end is caught under the reel end of the wire and twisted to kink and hold before the tension is released by cutting the wire. After twisting the ends together the tension on the wire is further augmented by kinking in at the corners in the manner shown in Fig. 2.

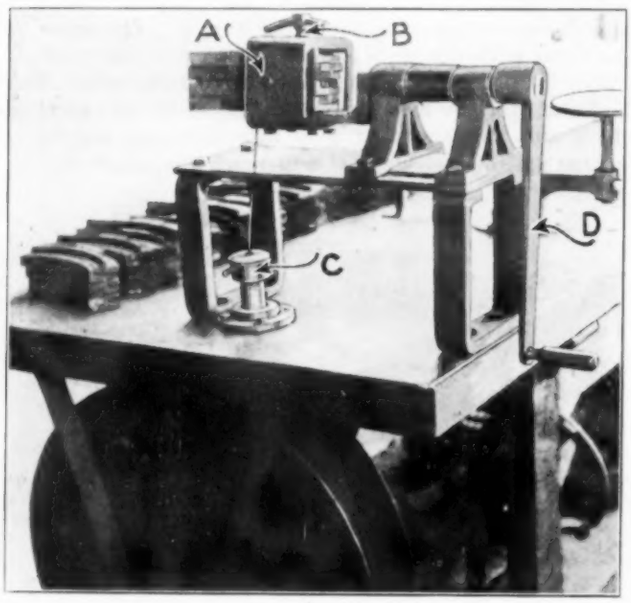
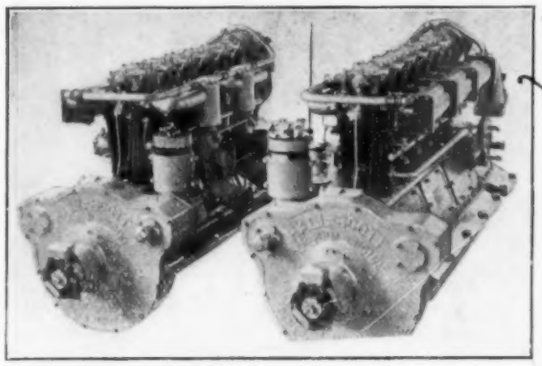


FIG. 6. WIRE BINDING DEVICE FOR BUNDLING PISTON RING SEGMENTS



BUILDING MOTORS ON THE PACIFIC COAST

By Fred H. Colvin
EDITOR-AMERICAN MACHINIST

This installment, the second of the series, takes up the machining of crankcases for both aircraft and marine types of motors, which are a departure from the usual marine motor when it comes to weight and finish. The methods can well be studied by anyone having moderate production problems.

MACHINING the crankcases for the Hall-Scott motor involves a number of interesting operations, as will be seen from the accompanying illustrations, which show the fixtures and machine set-ups for both aircraft and marine motor work. Machining operations begin with facing the ends of the bearings of an aircraft crankcase on the Lucas boring machine, as shown in Fig. 25, the cutter arbor carrying a gang of sixteen cutters. These cutters face not only the ends of the bearings inside the crankcase but also the outer ends.

Another milling operation on the same machine is shown in Fig. 26, where the pad for the water pump is being faced. Boring the holes through which the lower ends of the cylinders project and which locate the cylinders in their proper position, is shown in Fig. 27, both this and the succeeding operations being performed on the Cincinnati-Bickford radial drilling ma-

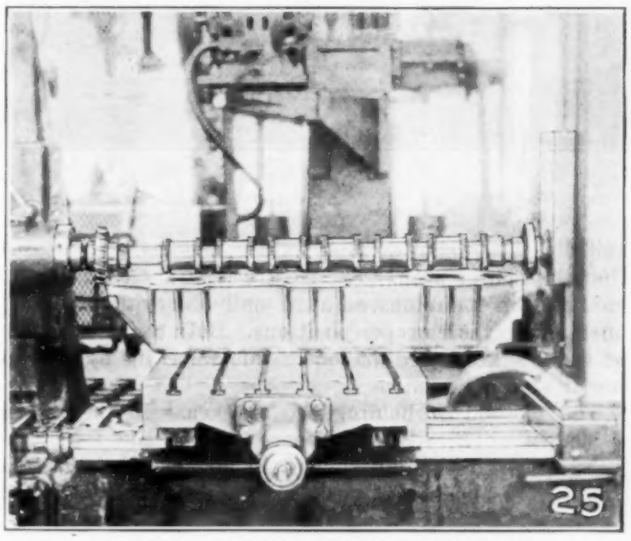


FIG. 25. FACING ENDS OF BEARINGS

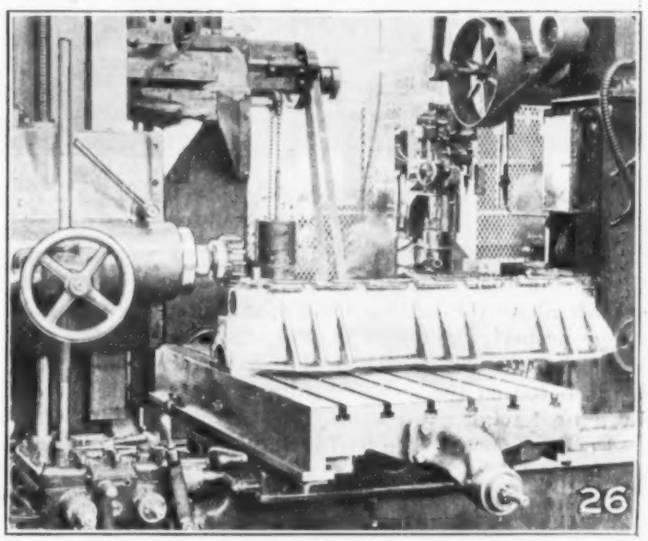


FIG. 26. MILLING WATER PUMP PADS

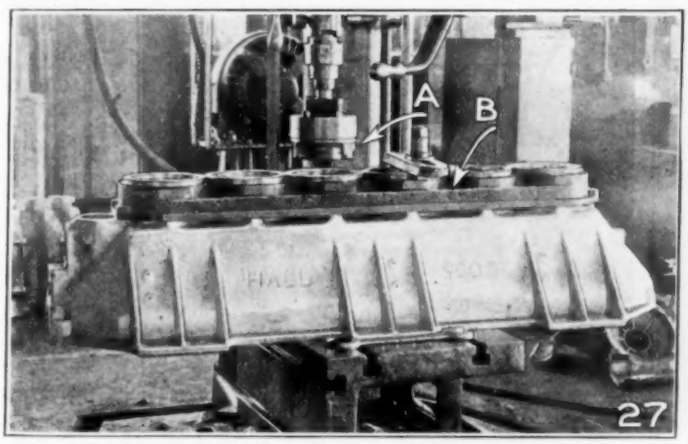


FIG. 27. BORING CYLINDER HOLES

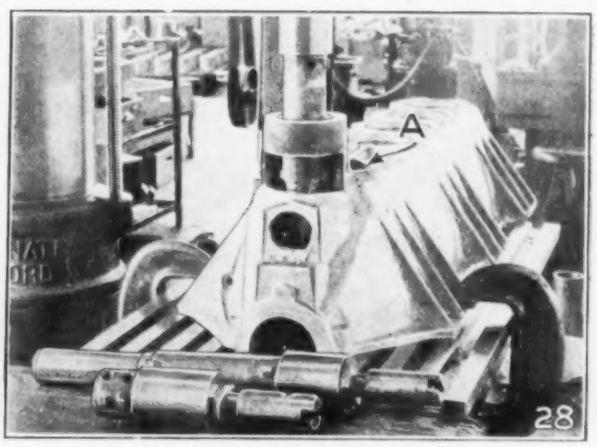


FIG. 28. BORING FOR VERTICAL SHAFT

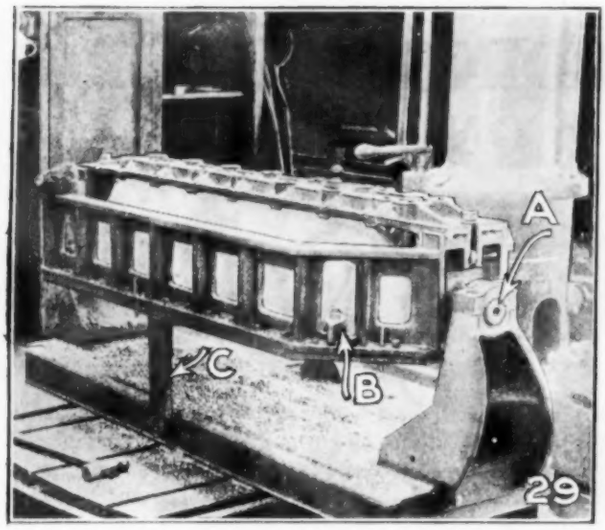


FIG. 29. DRILLING CYLINDER BOLT HOLES

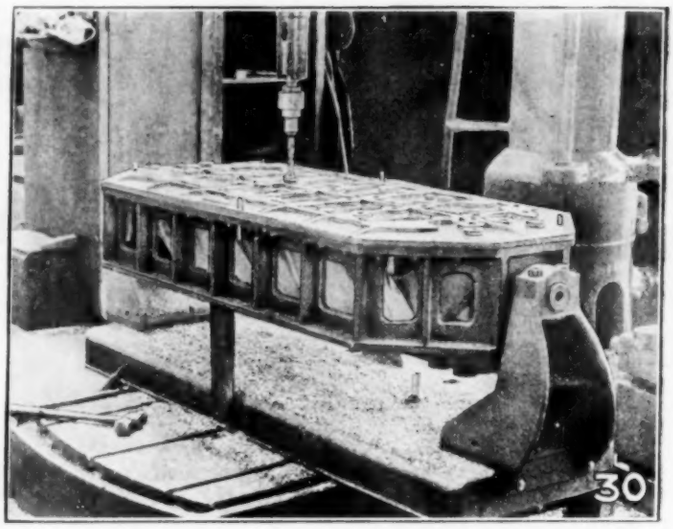


FIG. 30. DRILLING LOWER BOLT HOLES

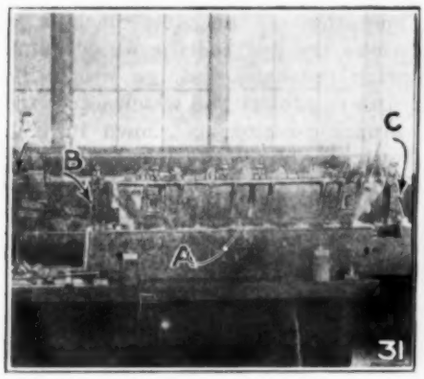


FIG. 31. LINE REAMING MAIN BEARINGS

FIG. 32. THE LINE REAMING MACHINE

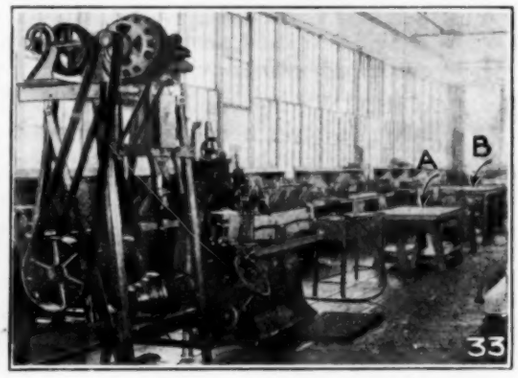


FIG. 33. REAMING MACHINE AND LAPPING TABLES

chine shown. The form of fixture used for guiding the boring tool *A* is shown at *B*. The large bearing surface above the cutting tools, insures the boring head being properly guided. In Fig. 28 the hole for the vertical shaft which drives the overhead camshaft, is being bored on the same machine. The hole is located by a jig having a projection at *A*, which fits into the end cylinder-hole. The boring tools are shown in front of the work.

Drilling the holes, both for holding down the cylinders and for the main bearing bolts, is shown in Figs. 29 and 30. The same drilling fixture handles both operations, as can be seen. The fixture is of the cradle type, mounted on trunnions as at *A* and carrying the drill bushings in their proper positions. Both top and bottom of the crankcase are drilled in this same jig by revolving it on the trunnions.

The method of holding the crankcase in the cradle is shown at *B*, Fig. 29, where one of the four toe-clamps used is plainly shown. The strut *C*, holds the cradle in a horizontal position in which it is assisted by another arm on the opposite side.

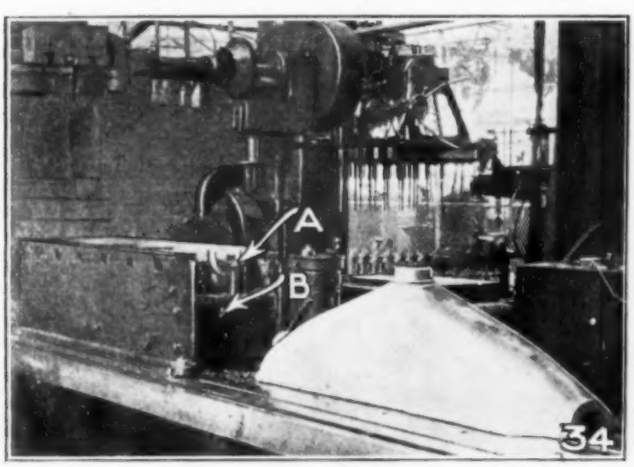


FIG. 34. MILLING LOWER HALF OF CRANKCASE

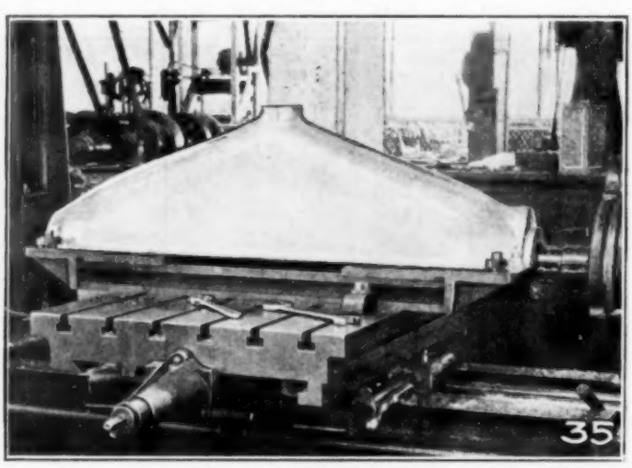


FIG. 35. BORING END OF LOWER HALF OF CRANKCASE

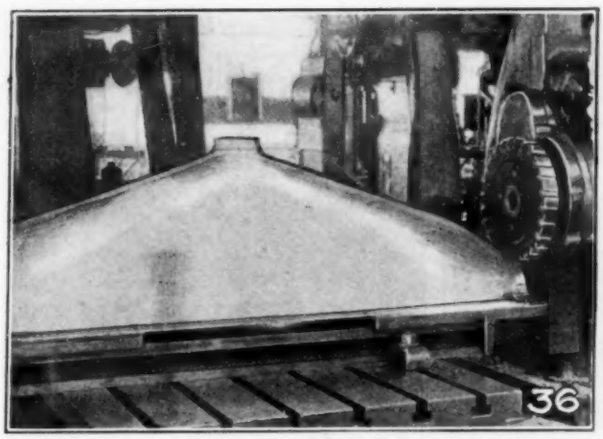


FIG. 36. FACING END OF LOWER HALF OF CRANKCASE

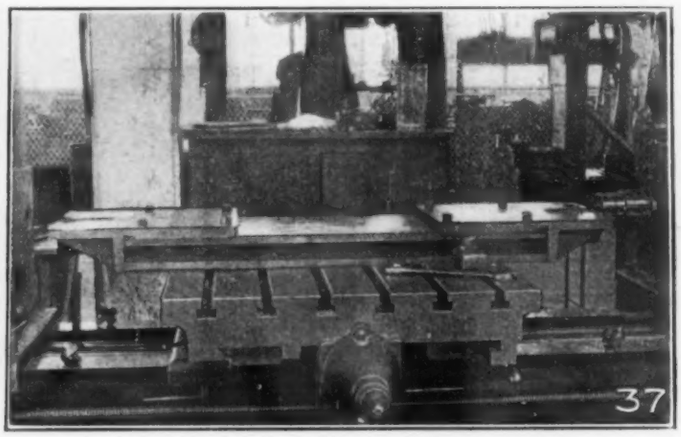


FIG. 37. THE BORING AND MILLING FIXTURE

The crankshaft bearings are next bored and reamed, the line reaming operation being shown in Fig. 31. Here the crankcase is supported on the substantial base *A*, while the uprights *B* and *C*, support the line reamer in correct relation to the cylinder face of the crankcase. The line reamer is driven by a Barnes horizontal drilling machine, through an Oldham coupling at *D*, the correct alignment not being dependent upon the machine itself. Fig. 32 shows a complete view of this machine and the fixture used. It also shows the crankshaft bearing caps bolted in position so as to be bored at the same time and to present a continuous surface to the boring tool.

The next illustration, Fig. 33, shows the sub-assembly department for the crankcases, with the lapping plates at *A* and *B*, and the line reaming machine in the foreground. This view also shows the power stand which has been erected for driving the reaming machine. The frame work is for the most part of angle iron, and carries the motor, jack shaft, and countershaft. This view also gives an excellent idea of the exceptional window area which makes this a particularly attractive shop.

The Lower Crankcase

Face milling the lower half of the aircraft crankcase, is shown in Fig. 34, an Ingersoll machine being used for this purpose. The type of milling fixture is a very simple box jig with suitable clamps as at *A*, and adjusting screws as at *B*, for holding the crankcase in its proper position.

More horizontal boring machine work is seen in Figs. 35, 36 and 37, the machine in this case being a universal. Fig. 35 shows the boring of the end of the crankcase, Fig. 36 the facing of the end with a large milling cutter, while Fig. 37 shows the fixture used and the boring cutter in position on the spindle.

The bolt holes are drilled under a Hammond radial drilling machine having a jointed arm, as shown in Fig. 38. This view also shows the light construction of the drilling jig. As the drill is brought to each hole and with only one hole drilled at a time, the jig is not subjected to any heavy strain.

The Marine Crankcase

The marine type of crankcase is shown in Fig. 39, on an Ingersoll milling machine where the joint surface is being faced with two vertical milling cutters. The mating half of this crankcase is also faced in a similar way and on the same machine, as in Fig. 40.

The recessed surfaces for the crankshaft-bearing caps are milled in the horizontal boring machine shown in Fig. 41, the outer end of the cutter arbor being supported by the special bracket shown.

Drilling the bolt holes for the crankcase is shown in

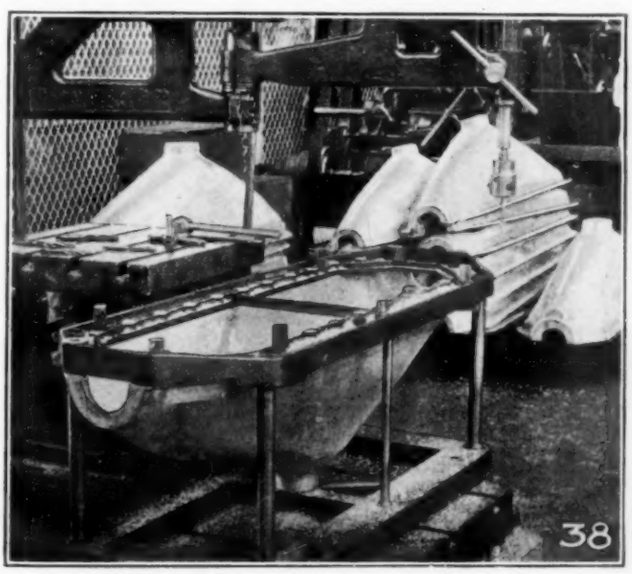


FIG. 38. DRILLING THE BOLT HOLES

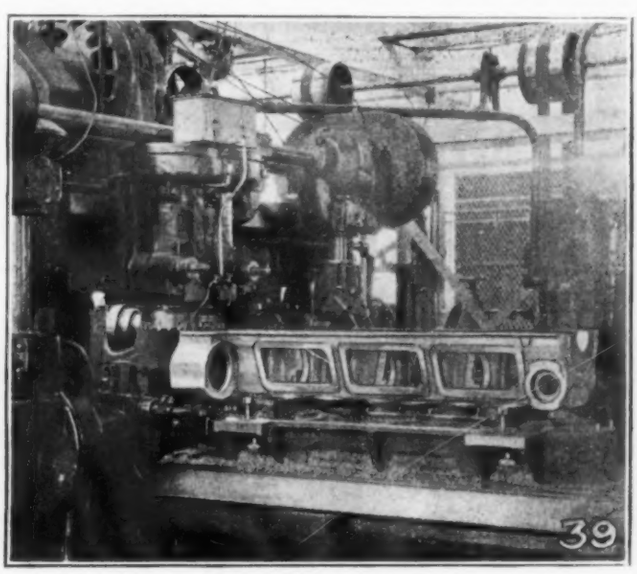


FIG. 39. FACING THE MARINE ENGINE BASE

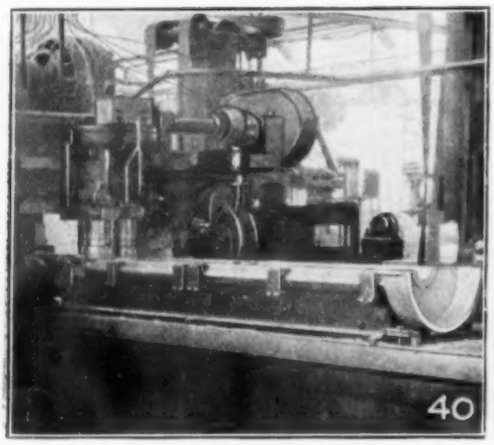


FIG. 40. FACING LOWER HALF

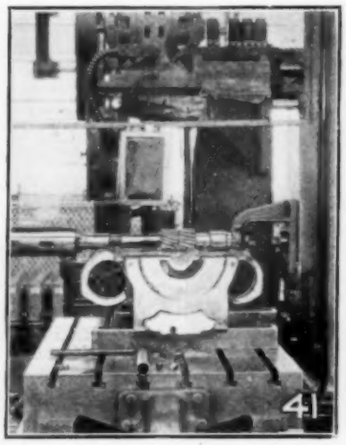


FIG. 41. MILLING FOR MAIN BEARING CAPS

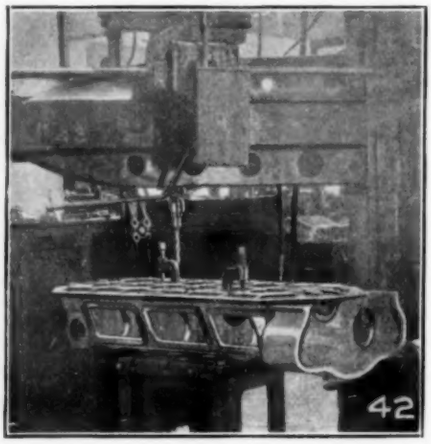


FIG. 42. DRILLING FLANGE BOLT HOLES

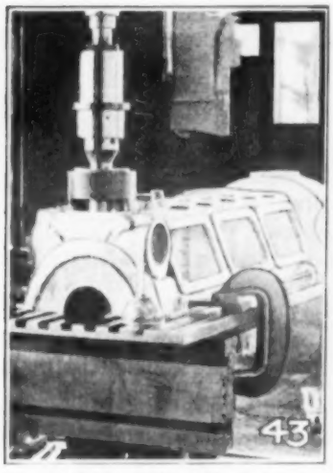


FIG. 43. BORING FOR VERTICAL SHAFT

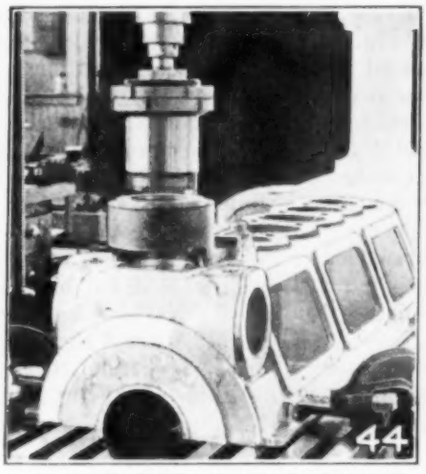


FIG. 44. COUNTER-BORING VERTICAL SHAFT HOLE

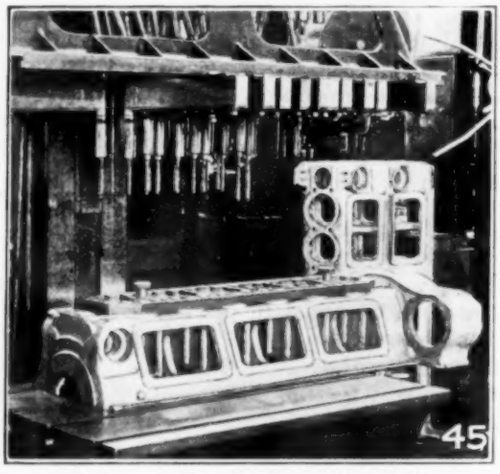


FIG. 45. DRILLING FOR CYLINDER FLANGES

Fig. 42. As these bolts are the same as in the aviation engine previously shown, the plate which carries the drill bushings is removed from the fixture shown in Fig. 30 and used by clamping in position as shown in Fig. 42. This obviates the necessity of duplicating an expensive drilling jig.

Boring and counter-boring the vertical-shaft bushing holes is shown in Figs. 43 and 44, the operation being practically the same as that for the aviation engine.

Another similarity with the aviation engine is the drilling of the cylinder flange bolt holes as shown in Fig. 45. As in the case of the lower bolt holes, the plate carrying the drill bushings is borrowed from one of the aviation drilling fixtures. The seats for the hand hole cover plates are milled on the universal machine shown in Fig. 46. This operation requires only a plate having a suitable angle for the base and simple means for clamping the work in place.

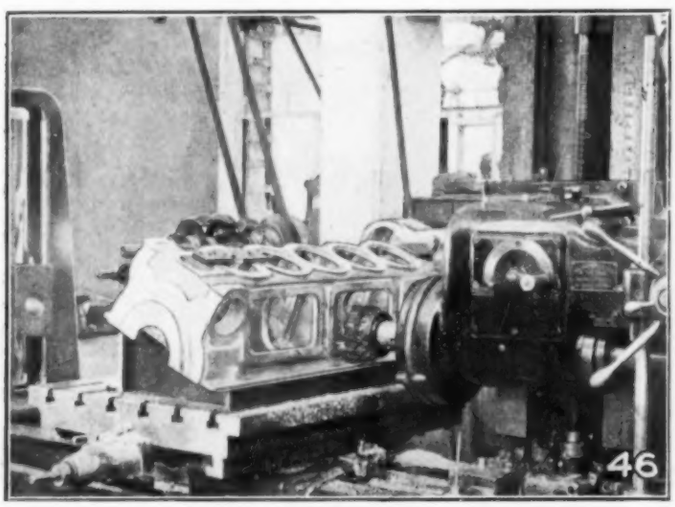


FIG. 46. FACING FOR HANDHOLE COVER PLATES

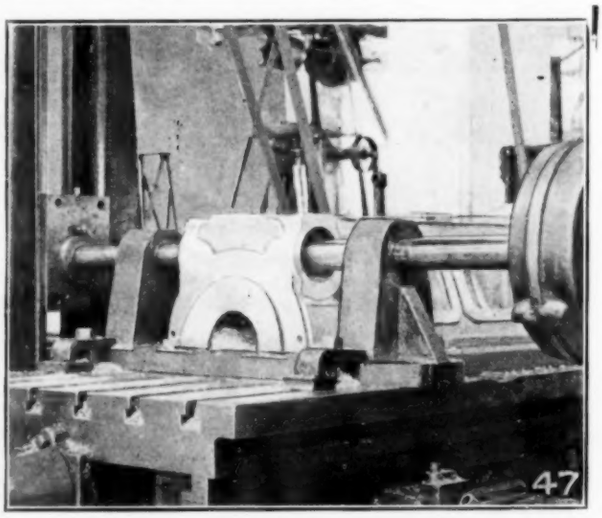


FIG. 47. BORING THE CROSSHOLE

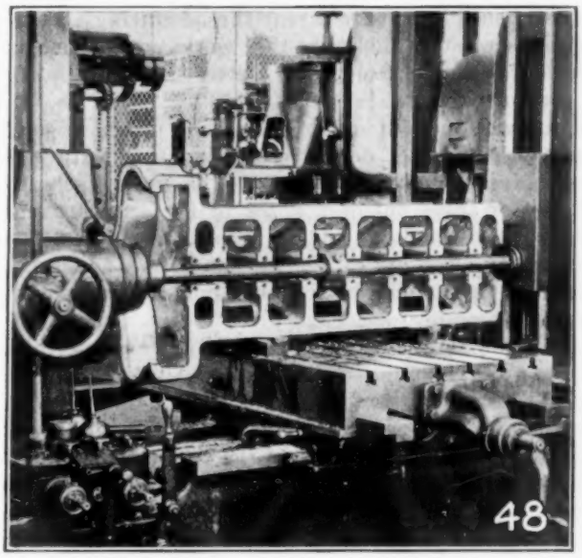


FIG. 48. FINISHING THE MAIN BEARING SEATS

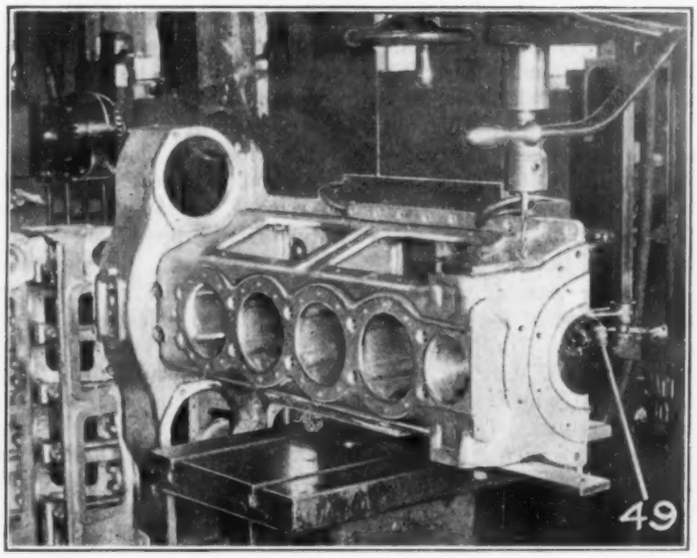


FIG. 49. DRILLING FOR PUMPS

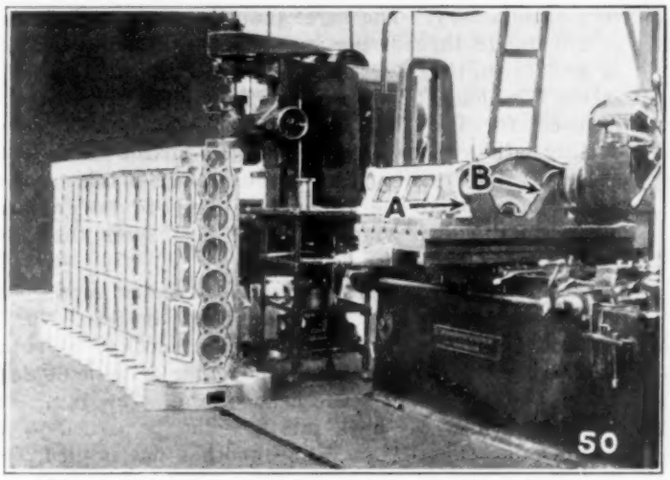


FIG. 50. BORING FOR STARTER AND GENERATOR

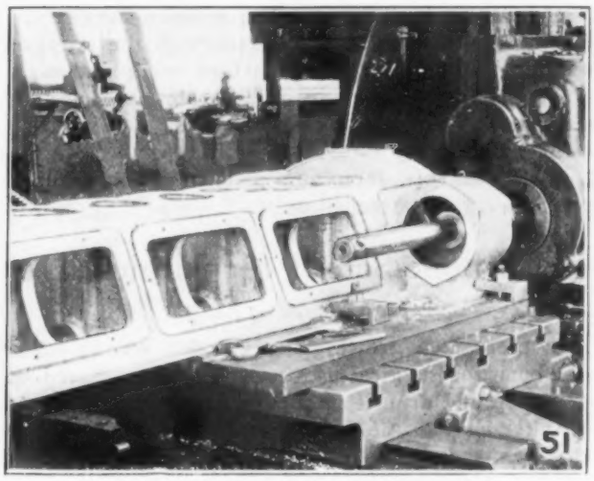


FIG. 51. BORING HOLE FOR GENERATOR

Boring the crosshole in the end of the crankcase for the water pump and oil pump bushings, is shown in Fig. 47. The fixture is simple but substantial and was designed for easy handling of the work and insuring the crosshole being at right angles to the main bearings.

The seats for the shells which form the main bearings are finished with single point cutters as shown in the boring bar at Fig. 48. It will be noted that this boring bar is supported both in the center and at each end in order to avoid spring, and insure the holes being in line and of correct diameter.

Drilling the stud holes for the water and oil pump

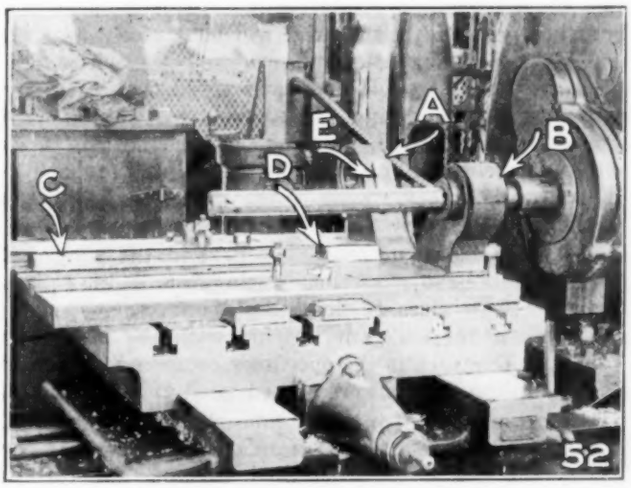


FIG. 52. THE BORING FIXTURE

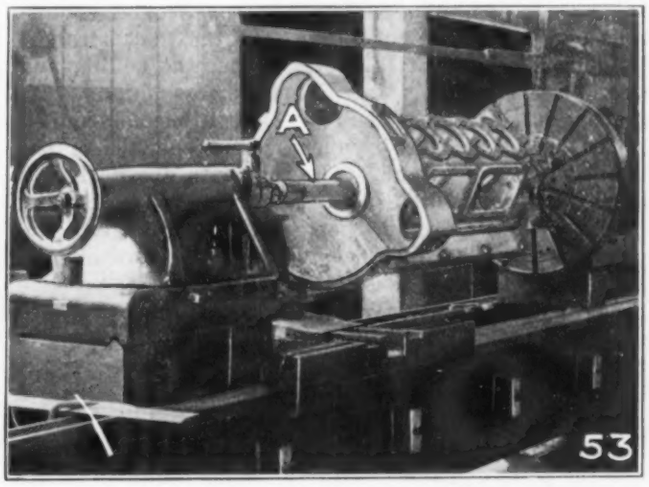


FIG. 53. FACING THE ENDS OF COMPLETE CRANKCASE

is accomplished with the simple drilling fixture shown in Fig. 49. The crankcase is clamped against a suitable angle plate and the drill jigs located with a bar to the crosshole which has already been bored.

The holes for the starter and generator at each side of the crankcase are bored on the universal machine shown in Fig. 50. These holes are located with reference to the main bearing seats, by the arms *A* and *B*, which form a substantial part of the fixture that supports the case while being bored.

Another view of this operation is shown in Fig. 51, and the type of tool used for finishing these holes may also be seen. Fig. 52 shows the fixture with the crankcase removed, showing the supports *A* and *B*, and also the blocks *C* and *D* which guide the case by means of the main bearings. The tool is shown at *E*.

The final facing of the ends of the crankcase so as to insure its being square with the crankshaft, is shown in Fig. 53. The upper and lower halves are bolted together around the mandrel *A* and swung between centers of an old Draper lathe which has had the headstock and tailstock raised for this purpose. Mounted in this way, it is an easy matter to have the surface of the flywheel housing faced square with the crankshaft bearings. This is very important where reverse or other gearing, housed in a separate case, is bolted to the end of the crankcase. Unless this precaution is taken it is very difficult to secure perfect alignment and without this, it is impossible to secure the best results from the attached units.

Beef-Bone Screws for Surgical Use

By George G. Little

As there is a growing demand for screws made of beef bone for surgical use in repairing fractured bones of the leg and arm, it may be of interest to the readers of the *American Machinist* to know something about what has been done in perfecting the methods of producing the screws ready for the operating room.

Some of the shops that do model work will undoubtedly be called upon to make screws of bone for surgeons in various parts of the country.

The joint ends of a front or rear shank beef-bone are sawed off, holding the bone in a bench vise and using a coarse-toothed hacksaw. The remaining sections are then boiled in clean water about one and one-half hours to remove the marrow and any tissue adhering to the outer surface. In removing the joint-ends only enough is cut off to leave the thick straight cylindrical portion of the bone. After the boiling and cleaning the bone is sawed into pieces suitable for the lengths of screws to be made. These pieces are then sawed lengthwise into segments large enough for the diameter of the screws. The segments are held in a lathe chuck and a high-speed tool, ground as for cutting brass, is used to rough them out. They are then re-chucked in a draw-in collet and sized for threading.

Soaking the cylindrical blanks in pure vaseline brought to the melting point, for an hour or two, will replace some of the natural oil of the bone and make the finishing of the thread easier. It also lessens the danger of breaking the screws when the surgeon starts them into the holes in the fractured bones.

Before the blanks are threaded they should be pointed and the point-end supported in a female center to insure the threaded portion being of one diameter throughout.

A small bench lathe with a rear thread cutting attachment is the most suitable for this work as the bone is brittle and a single tool proves better than any other kind for forming the thread.

Three sizes of solid or split dies will produce good threads with a great deal of care, starting with the larger and stepping down, but one is very likely to break two or three out of a dozen of the screws using the dies. The hands should be washed clean and the work kept as clean as is possible and after the screws are finished they should be scrubbed in clean water with ivory, castile or lava soap and dried with a clean cloth.

If an ordinary screw-cutting lathe is used with a single tool for forming the thread, the tool should be shaped the same as for steel and fed to the work at an angle of 30 deg., but I find that with the back attachment of the bench lathe, if the tool is fed straight in to the work, it produces a smooth thread. There is no breakage with this method.

There are three standard diameters of bone screws produced for and used in the operating rooms of the Mayo Clinic, Rochester, Minn., and they have proved very satisfactory. The three diameters are as follows: $\frac{7}{16}$ x 3 in., 18 threads per inch; No. 10 machine screw, $1\frac{1}{8}$ and $1\frac{1}{2}$ in. long, 24 threads per inch; No. 6 machine screw 1 in. long, 32 threads per inch. The largest size is used for hip fractures only. Any small screw-cutting lathe can be used to size and thread the screws especially if threading dies are used but it takes quite a bit longer and the thread is likely to be crooked owing to the dies gouging in the soft spots that are in the bone.

In cutting the thread with dies the point support is not used. In forming the hex head an 8-in. No. 0 narrow pillar file is used. A filing block $\frac{3}{4}$ x 1 in. having one end squared and the other with a 60-deg. V in it is a big help. The head of the screw is placed in the V and a flat filed, this first flat is turned to fit against one side of the V and another flat is filed, the two flats are then turned to fit the two sides of the V and the third flat is filed, this forming every other side of the head.

The plain squared end of the filing block is now turned up. One of the three flat sides is placed on the block, this bringing one of the unfinished sides up ready to be filed flat. The remaining two unfinished sides are filed in the same manner. If care is taken to hold the screw level, have the block level and to file level with the vise and to remove only enough to make the flats the right width, the head will be a nicely finished hex. With a little practice and care the heads can be filed to size with less trouble and more speed than they can be formed by machining. We have tried milling with end mills, side cutters, plain cutters and slitting saws with sides relieved, but found that none of the machining was satisfactory, owing to the time it took and the breakage of the screws in spite of the care given.

The filing block, of course, is held in the vise, and it is well to have a section of the bone 1 in. square with the three sizes of holes taped out for inspection gages, as if there is any trouble with the diameters it balls up the work in the operating room and the fellow that made the screws gets cussed good and plenty.

A short piece of $\frac{1}{4}$-in. steel tube shaped over a $\frac{7}{16}$-in. hex cold-rolled bar makes a standard socket wrench for gaging the size of the head when forming and for the surgeon to use to place the screws.

Tests of Cast Iron for Locomotive-Cylinder Parts*

Frequent renewal of cylinder parts of locomotives results in greatly increased cost of maintenance to the railroads, and consequently the quality of the cast iron entering into their construction is a matter of paramount importance, particularly from the standpoint of wear. These parts include piston-valve bushings, packing rings and bull rings, cylinder bushings, piston packing rings, and piston-head or bull rings. It was found that ordinary high-silicon cast iron gave unsatisfactory wear, particularly in modern superheater locomotives, and the tendency has been toward a harder and stronger iron.

AT THE request of the former U. S. Railroad Administration the Bureau of Standards has investigated the mechanical, chemical, and microscopical properties of a number of packing rings furnished with service-mileage records, as well as arbitration-test bars, chill-test specimens, and miscellaneous samples from different manufacturers. All of this material was cast iron such as used for the various cylinder parts. It was desired at the same time to review the previous work and specifications on this subject, to ascertain as far as possible the practices of the different foundries and to suggest such revision of existing specifications as would be warranted by the results of the present and of earlier investigations.

The samples, 131 in number, were furnished to the Bureau of Standards by the U. S. Railroad Administration. The first samples were received April 2, 1919, and the last September 26, 1919, nine foundries supplying specimens.

Mechanical Tests

The mechanical tests made at the Bureau of Standards consisted of transverse, tension, hardness, and fracture tests of chill-test specimens.

Transverse Tests. Thirty-four arbitration bars, ordered made in accordance with the standards of the American Society for Testing Materials, from six different manufacturers, were tested.

When the packing rings furnished were sufficiently large in size, specimens for small transverse tests were machined from them also. It is not to be expected that these results will be similar to those on unmachined arbitration bars, because of the absence of skin or surface hardness.

Tension Tests. After breaking the arbitration bars in the tranverse tests, the broken pieces were used to determine the tensile strength of the material. Tension tests were made from packing rings furnished by four foundries. From the tension tests, at least, there appears to be some more or less definite relation between laboratory and service tests.

Brinell Hardness Tests. Brinell hardness tests, using a 10-mm. ball with a pressure of 3,000 kg., sustained for 30 seconds, were made on flat, longitudinal sections of the arbitration bars. Approximately $\frac{1}{4}$ in. of material was removed by the shaper to obtain a surface for the Brinell tests. As there is a variation of only 10 points from the maximum to minimum hardness, it is concluded that, in view of the widely varying quality of the irons as indicated by other tests, the Brinell test does not satisfactorily measure the quality of iron for cylinder parts.

The Brinell hardness tests of packing rings and bushings indicate that the castings themselves are considerably softer than the arbitration bars. This is undoubtedly due to the fact that the slower rate of cooling of the former results in a higher graphitic carbon content.

Chill Tests. Chill-test specimens were received from four foundries and broken at the Bureau of Standards, four to six samples of the product of each foundry having been submitted.

Chemical Analysis

Chemical analyses were made of one of each of the arbitration bars from each of six foundries. The various bars were quite uniform in total, graphitic, and combined carbon content. The silicon and sulphur contents, however, varied within rather wide limits, the former from 1 per cent to 1.47 per cent and the latter from 0.051 per cent to 0.167 per cent. The phosphorus content varied from 0.37 to 0.56 per cent; manganese from 0.36 to 0.90 per cent. It is generally recognized that there should be at least three times the percentage of manganese as sulphur present; otherwise, sulphur will combine with iron instead of manganese, and brittle material will result.

In general, the silicon, and naturally the graphitic carbon is higher in the packing rings, bushings, and similar castings than in the arbitration bars. A ring which gave 93,000 miles in service showed no unusual characteristics in chemical composition.

Metallographic Examination

The samples were polished and examined microscopically both before and after etching. Heat tinting was found to be very suitable for revealing the irregularly shaped masses of phosphide eutectic and at the same time allowing the black flakes of graphite to stand out clearly. Micrographs were taken only of typical samples selected for purposes of illustration.

Some attempt was made to correlate the microstructure with the endurance in service, but, due to the many variable factors, it was realized that any very close comparisons were apt to be misleading. The inhomogeneity of cast iron made it somewhat doubtful that the small sample used for metallographic examination was representative of the whole. In some instances, however, with the aid of the principles governing the constitution of gray cast iron, the samples could be approximately classified, and the service records bore out fairly well the predictions that could be made of mechanical qualities from a study of the microstructure.

The microscope is most useful in determining the size, amount, and distribution of graphite flakes, amount of combined carbon, and to some extent the physical soundness of the castings.

*From Technologic Paper No. 172 of the Bureau of Standards, Washington, D. C., entitled "Cast Iron for Locomotive-Cylinder Parts," by C. H. Strand, issued Sept. 11, 1920.

Conclusions are drawn and recommendations made as follows:

On the basis of test made by inspectors of the U. S. Railroad Administration and of the Bureau, which were substantially in agreement, it is concluded that air furnace or so-called "gun iron" is more uniform in character and on the average of somewhat better mechanical properties than cupola iron. The latter, however, often equals or even excels in mechanical properties the specimens of air-furnace iron tested in this investigation. The sulphur content of the air-furnace irons examined seldom exceeded 0.06 per cent, while the cupola iron varied in sulphur content from 0.10 to 0.17 per cent.

It was impossible, except in a very general way, to find any correlation between the quality of the iron as developed by laboratory tests and the mileage obtained in service. This is explained by the fact that many other factors besides the quality of the iron enter into consideration in the service results, namely, design, lubrication, method of handling the locomotive, topography of the country, character of water used in the locomotive, etc. It is for the reasons cited above that the conclusions and recommendations of this paper are based essentially upon the results of laboratory tests.

The present specifications of the American Railway Master Mechanics' Association are somewhat lax in the requirements for mechanical properties. It is recommended that the transverse-strength requirements of a 1¼-in. arbitration bar on supports 12 in. apart be increased from 3,200 to 3,500 lb. for castings ½ in. or less in thickness, and from 3,500 to 3,800 pounds for castings over ½ in. in thickness. It is further recommended that the minimum deflection requirements for both cases be increased from 0.09 to 0.11 in. The rate of application of the load shall be from 20 to 40 seconds for a deflection of 0.01 in. The division line of the casting thickness is changed from ⅝ in. of the American Railway Master Mechanics' Association, to ½ in. in order to conform to the recognized standards of the American Society for Testing Materials. Two arbitration-test bars, cast as specified, should be poured from each ladle used for one or more castings.

Composition Recommendations

It is preferable to leave the chemical composition and the melting process used to the manufacturer, depending for the most part on the mechanical tests, and of these primarily upon the transverse test. The existing specifications allow a maximum of 0.70 per cent phosphorus and 0.12 per cent sulphur; there are no developments in this investigation which would warrant a revision of the maximum permissible amounts of these elements.

For the chill test a sample of the iron shall be taken before pouring and chilled in a cast-iron mold. The sample shall be allowed to cool in the mold until it is dark red or almost black, when it may be knocked out and quenched in water. On being broken, it must show a close-grained gray iron, with a well-defined border of white iron at the bottom of the fracture. The depth of the white iron must not be less than $\frac{1}{16}$ in. as measured at the center line, for castings ½ in. or less in thickness, nor less than ⅛ in. for castings over ½ in. in thickness. One chill test shall be poured from each ladle of metal used for one or more castings. The specimens may be cast in adjacent molds, but in such cases a space must be provided between the molds.

Castings shall, of course, be smooth, well cleaned, free from shrinkage cracks and from other defects sufficiently extensive to impair their value, and must finish to blueprint size.

The purchaser, or his inspector, shall be given a reasonable opportunity to witness the pouring of the castings and test specimens, as well as to be present when the mechanical tests are made. Inspection shall be made at the place of manufacture, and the manufacturer shall also furnish the facilities for making the mechanical tests, if desired.

Side-Cutting of Thread-Milling Hobs*

By Earle Buckingham

(Continued from last week's issue)

The hobbing of internally threaded parts, when the axis of the hob is parallel to the axis of the thread which is being cut, develops conditions which are similar in many respects to those which occur in the hobbing of screws which have previously been discussed. The same symbols will be used in this discussion as were used in regard to the hobbing of screws and formulas will be derived to show the interference between the path of any cutting point on the hob and the flanks of the thread.

Fig. 9 shows a diagram of a hob and the thread is a nut which it is cutting. It will be noted that the value of y is:

$$y = r - r' \qquad [9]$$

The equation for x is identical with equation [6] for hobbing screws; namely,

$$x = y \tan C - \frac{B}{360N}$$

In order to determine the value of y, the triangle shown in heavy lines in Fig. 9 must be solved. The known values will be taken as r, R and B. From the relation

$$(r - R) \sin B = R \sin (A - B)$$

$$\frac{(r - R) \sin B}{R} = \sin (A - B) \qquad [10]$$

And given the value of B and $(A - B)$, the value of A is readily determined. Solving the triangle for r', we have

$$r' = \frac{R \sin (180^\circ - A)}{\sin B} = R \frac{\sin A}{\sin B} \qquad (11)$$

The value of y is then determined by equation [9].

In order to determine the nature of the side-cutting the following example will be taken: A hob 0.800 in. in outside diameter will be used to hob an internal Acme thread, 2.000 in. in outside diameter, 4 threads per inch.

First determine the maximum side-cutting at the largest diameter of the work. The known values are then $r = 1.000$, $R = 0.400$, $N = 4$, and $C = 14\frac{1}{2}$ deg., from which the following coefficients are obtained:

*Presented at the annual meeting of the American Society of Mechanical Engineers, New York, Dec. 7 to 10, 1920.

For	B =	5°	6°	7°
	x =	—0.001995	—0.002039	—0.001928
	y =	0.005710	0.008230	0.011240

The side-cutting at a point 0.100 in. farther down the flank of the thread will next be determined. In this

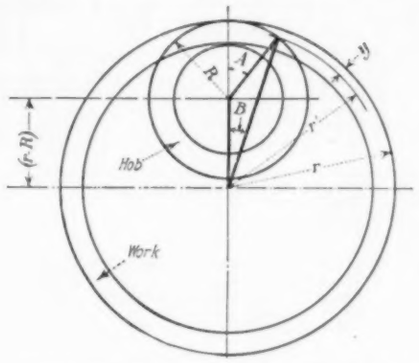


FIG. 9. DIAGRAM OF HOB AND INTERNAL SCREW

case $r = 0.900$ in., $R = 0.300$ in. and these give the following coefficients:

For	B =	4°	5°	6°
	x =	—0.001644	—0.001698	—0.001607
	y =	0.004383	0.006858	0.009900

When the side-cutting is at a point 0.200 in. below the largest diameter of the work, $r = 0.800$ in. and $R = 0.200$ in., giving the following coefficients:

For	B =	3° 30′	4°	4° 30′
	x =	—0.001297	—0.001303	—0.001236
	y =	0.004384	0.005704	0.007304

These values are plotted in Fig. 10. In general, the curve is very similar to the one shown in Fig. 4, except that the flank of the thread in the work is concave instead of convex as in the case of a hobbed screw. It will also be found that on hobbed nut threads the curvature of the flank of the thread is much less than on hobbed screw threads, while the amount of side-cutting at the point, both on the x-axis and y-axis, is much greater; in other words, the fillet at the bottom of the hobbed thread will be larger.

Fig. 11-A represents the form of the thread which would be cut with a hob whose form was that of a standard thread. The values employed are the same as those used in discussing the hobbing of screws. Fig. 11-B represents a corrected hob and the form of thread cut with it. The formula for the corrected angle of the hob will be very similar to that for external hobbing, and is given by the equation:

$$\tan C' = \tan C + \frac{x_1 - x_2}{r_1 - r_2} \qquad (12)$$

As with the external hobs, the true correction of the hob would be in a curved line. This is indicated by the dotted line in Fig. 10-B. In this case, however, the flank of the hob should be concave instead of convex as in the case of external hobs. If the fillet at the bottom of the thread should be objectionable, the point of the hob could be extended by an amount equal approximately to y_2 if undercutting was permissible.

In the example given previously, we have the following values:

$C_1 = 14° 41′ 52″$ $\qquad x_1 = 0.002039$ in.

$K = 0.000027$ in. $\qquad y_1 = 0.008230$ in.

In order to determine the effect of varying the diam-

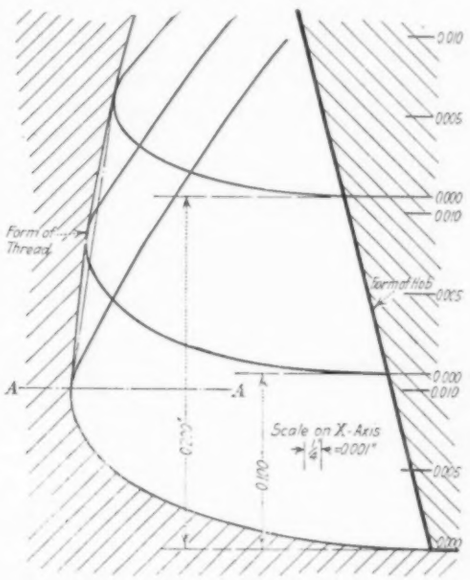


FIG. 10. CURVES SHOWING FORM OF INTERNAL THREAD

eter of the hob, two further examples will be taken: First, with the outside diameter of the hob equal to 1.200 in. and second, with it equal to 1.600 in.

The following tabulation is made to show the effects

TABLE III. VALUES OF y/r FOR r/R = 1.1 TO 4.0 (INTERNAL THREADS)

		Ratio r/R													
B	$B/360°$	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.5	3.0	3.5	4.0
1°	0.002778	0.00001	0.00001	0.00001	0.00002	0.00002	0.00003	0.00004	0.00005	0.00006	0.00007	0.00019	0.00031	0.00039	0.00046
2°	0.005556	0.00005	0.00010	0.00015	0.00020	0.00025	0.00031	0.00037	0.00043	0.00049	0.00055	0.00089	0.00122	0.00147	0.00178
3°	0.008333	0.00010	0.00023	0.00036	0.00049	0.00063	0.00077	0.00091	0.00105	0.00119	0.00133	0.00204	0.00274	0.00336	0.00398
4°	0.011111	0.00021	0.00045	0.00069	0.00093	0.00117	0.00141	0.00166	0.00191	0.00216	0.00241	0.00364	0.00487	0.00600	0.00713
5°	0.013889	0.00035	0.00073	0.00111	0.00149	0.00187	0.00225	0.00263	0.00301	0.00340	0.00379	0.00571	0.00762	0.00945	0.01128
6°	0.016667	0.00052	0.00107	0.00162	0.00217	0.00272	0.00327	0.00382	0.00437	0.00492	0.00547	0.00823	0.01100	0.01369	0.01673
7°	0.019444	0.00072	0.00146	0.00220	0.00295	0.00370	0.00445	0.00520	0.00595	0.00670	0.00745	0.01124	0.01502	0.01879	0.02255
8°	0.022222	0.00095	0.00192	0.00289	0.00386	0.00483	0.00581	0.00679	0.00777	0.00875	0.00973	0.01470	0.01967	0.02477	0.02987
9°	0.025000	0.00121	0.00244	0.00367	0.00490	0.00613	0.00736	0.00859	0.00983	0.01107	0.01231	0.01864	0.02498	0.03167	0.03877
10°	0.027778	0.00150	0.00302	0.00454	0.00606	0.00758	0.00910	0.01062	0.01214	0.01366	0.01519	0.02306	0.03094	0.03952	0.04811
11°	0.030556	0.00182	0.00365	0.00549	0.00733	0.00917	0.01101	0.01285	0.01479	0.01663	0.01837	0.02797	0.03757	0.04835	0.05913
12°	0.033333	0.00217	0.00435	0.00653	0.00871	0.01090	0.01309	0.01528	0.01747	0.01966	0.02185	0.03331	0.04486	0.05817	0.07148
13°	0.036111	0.00255	0.00511	0.00767	0.01023	0.01279	0.01535	0.01792	0.02049	0.02306	0.02563	0.03923	0.05283	0.06902	0.08521
14°	0.038889	0.00296	0.00593	0.00890	0.01187	0.01484	0.01781	0.02078	0.02375	0.02673	0.02971	0.04560	0.06149	0.08092	0.10036
15°	0.041667	0.00340	0.00681	0.01022	0.01363	0.01704	0.02045	0.02386	0.02727	0.03068	0.03409	0.05246	0.07084	0.09392	0.11699
16°	0.044444	0.00387	0.00774	0.01161	0.01548	0.01935	0.02323	0.02711	0.03099	0.03487	0.03875	0.05983	0.08091	0.10807	.....
17°	0.047222	0.00437	0.00874	0.01311	0.01748	0.02185	0.02622	0.03059	0.03496	0.03933	0.04371	0.06777	0.09183	0.12341	.....
18°	0.050000	0.00489	0.00978	0.01467	0.01956	0.02446	0.02936	0.03426	0.03916	0.04406	0.04896	0.07630	0.10365	0.14000	.....
19°	0.052778	0.00544	0.01089	0.01634	0.02179	0.02724	0.03269	0.03269	0.04359	0.04904	0.05449	0.08548	0.11647	0.15789	.....
20°	0.055556	0.00602	0.01205	0.01808	0.02411	0.03014	0.03617	0.04220	0.04823	0.05427	0.06031	0.09535	0.13039	0.17713	.....
21°	0.058333	0.00663	0.01327	0.01991	0.02655	0.03319	0.03983	0.04647	0.05311	0.05976	0.06641	0.10593	0.14546	.....	.....
22°	0.061111	0.00726	0.01454	0.02182	0.02910	0.03638	0.04366	0.05094	0.05822	0.06551	0.07280	0.11725	0.16171	.....	.....
23°	0.063889	0.00792	0.01587	0.02382	0.03177	0.03972	0.04767	0.05562	0.06357	0.07152	0.07947	0.12932	0.17917	.....	.....
24°	0.066667	0.00861	0.01725	0.02589	0.03454	0.04319	0.05184	0.06049	0.06914	0.07779	0.08644	0.14213	0.19783	.....	.....
25°	0.069444	0.00933	0.01870	0.02807	0.03744	0.04681	0.05618	0.06555	0.07493	0.08431	0.09369	0.15567	0.21766	.....	.....

of varying the diameter of the hob. (Diameter of work = 2.000 in.; 4 Acme threads per inch, see Fig. 11-A):

Diameter of hob =	0.800 in.	1.200 in.	1.600 in.
x_1 =	0.002039	0.004615	0.012734
y_1 =	0.00823	0.017063	0.052800
$2C'$ =	29° 23′ 44″	29° 25′ 6″	29° 28′ 8″

It will be noted that the same general principles hold true, as regards the effect of increasing the diameter of the hob, for both external and internal hobbing. The amount of side-cutting (x_1) and the height of the fillet (y_1) increase considerably as the diameter of the hob increases, while the included angle of the corrected hob increases but very slightly. If a tangential correction at the pitch line is used, the formula for determining C' given for screws can also be used for nuts.

In order to determine the effect of varying the diameter of the work, the following tabulation is made:

Diameter of work =	2.00 in.	3.000 in.	4.000 in.
x_1 =	0.012734	0.002342	0.001028
y_1 =	0.052800	0.009739	0.004080
$2C'$ =	29° 28′ 8″	29° 10′ 24″	29° 5′ 52″

This tabulation shows the same general conditions as exist in external hobbing. As the diameter of the work increases, the side-cutting (x_1), the height of the fillet (y_1) and the angle of the corrected hob decrease quite rapidly. Thus a hob which is corrected for a certain diameter of work would introduce a noticeable error when used for cutting a different diameter. The amount of this change also decreases quite rapidly as the diameter of the work increases. Beyond a certain diameter of work, therefore, no correction would be practically required.

It will be noted, if comparison is made with external hobbing, that the amount of side cutting in internal hobbing is very much greater although the correction in angle is somewhat similar.

In order to simplify the calculations, Tables III and IV have been prepared. These are similar to Tables I and II, and are to be used in exactly the same manner.

It has been a common belief that for internal hobbing the hob should be made as small as possible. As a matter of fact, any 60-deg. thread which does not have a sharper helix than any of the U. S. standard threads can be hobbed satisfactorily, with as large a hob as will clear the tap-drill diameter, provided the hob is suitably corrected. The only effect, beyond a slight modification in the hob form, which is caused by the use of a smaller hob is the reduction of the height of fillet (y_1) at the bottom of the hob. To overcome this, when the height may be objectionable, the point of the hob may be extended, thus producing a slight undercut, which is nearly always permissible.

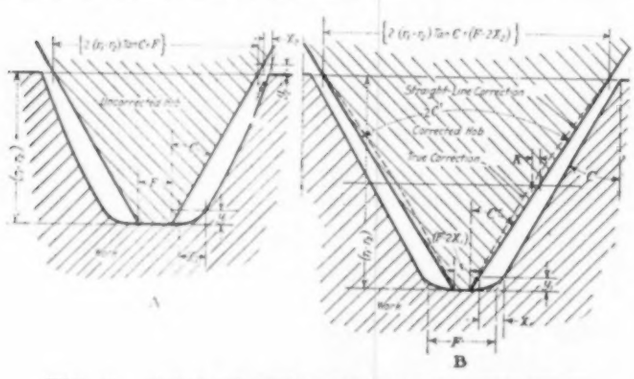


FIG. 11. FORM OF INTERNAL THREAD CUT WITH UNCORRECTED AND CORRECTED HOBS

TABLE IV. VALUES OF y/r FOR r/R = 1.1 TO 1.7 (INTERNAL THREADS)

		Ratio r/R						
B	$B/360°$	1.1	1.2	1.3	1.4	1.5	1.6	1.7
26°	0.072222	0.01008	0.02020	0.03032	0.04044	0.05056	0.06069	0.07082
27°	0.075000	0.01085	0.02175	0.03265	0.04355	0.05445	0.06536	0.07627
28°	0.077778	0.01165	0.02336	0.03507	0.04678	0.05849	0.07020	0.08191
29°	0.080556	0.01247	0.02501	0.03755	0.05009	0.06263	0.07518	0.08773
30°	0.083333	0.01331	0.02671	0.04011	0.05351	0.06692	0.08033	0.09374
31°	0.086111	0.01418	0.02847	0.04276	0.05705	0.07134	0.08584	0.09994
32°	0.088889	0.01507	0.03028	0.04549	0.06070	0.07591	0.09112	0.10633
33°	0.091667	0.01599	0.03213	0.04828	0.06443	0.08058	0.09673	0.11288
34°	0.094444	0.01694	0.03405	0.05116	0.06827	0.08538	0.10249	0.11960
35°	0.097222	0.01791	0.03601	0.05411	0.07221	0.09031	0.10841	0.12651
36°	0.100000	0.01891	0.03802	0.05713	0.07624	0.09535	0.11446	0.13358
37°	0.102778	0.01993	0.04008	0.06023	0.08038	0.10053	0.12068	0.14084
38°	0.105556	0.02097	0.04219	0.06341	0.08463	0.10585	0.12707	0.14829
39°	0.108333	0.02205	0.04435	0.06666	0.08897	0.11128	0.13359	0.15590
40°	0.111111	0.02315	0.04657	0.06999	0.09341	0.11683	0.14025	0.16367
41°	0.113889	0.02429	0.04882	0.07337	0.09792	0.12248	0.14704	0.17160
42°	0.116667	0.02540	0.05111	0.07682	0.10254	0.12826	0.15398	0.17970
43°	0.119444	0.02655	0.05345	0.08035	0.10725	0.13415	0.16105	0.18796
44°	0.122222	0.02772	0.05583	0.08394	0.11205	0.14016	0.16827	0.19638
45°	0.125000	0.02891	0.05825	0.08759	0.11694	0.14629	0.17564	0.20499

Due to the above-mentioned misapprehension in regard to internal hobbing, this method of manufacture has been seldom used except on threads of about two inches and over in diameter. It will be seen from the foregoing, however, that it is practical for threads three-quarters of an inch in diameter and upward, and under some circumstances it can be successfully used on even smaller diameters.

Inaccessibility of Auto Parts

BY GEORGE LITTLE

While discussing the inaccessibility of automobile mechanism with an auto-repair instructor, the question came up of how much time was lost unavoidably by mechanics in getting at parts which required adjustment or repair. He roughly estimated this time at about 75 per cent.

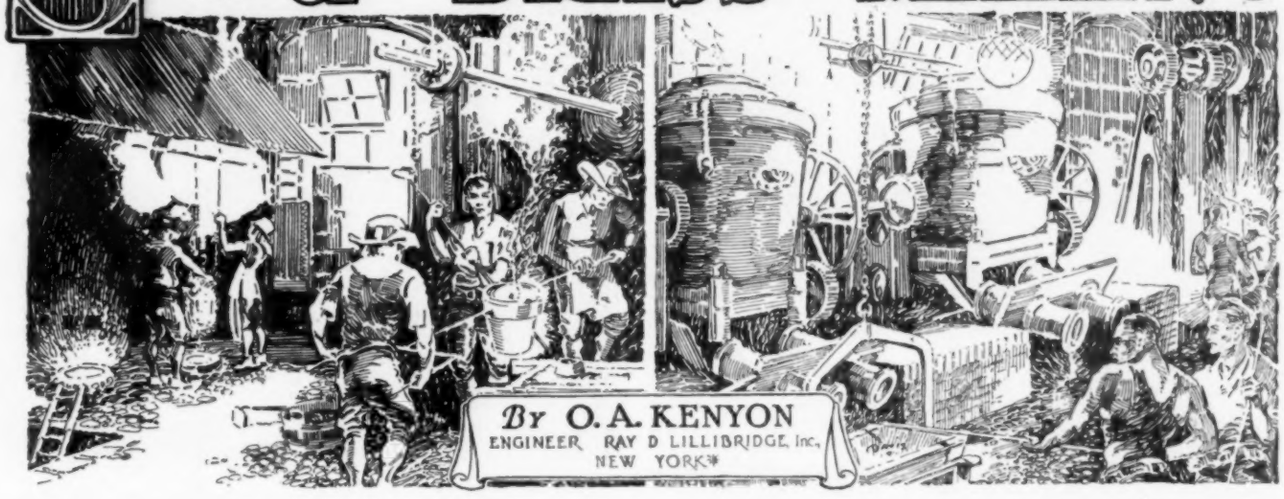
Recently, oil leaked from the crankcase of my car, so I took a half-day off with the thought that I would get it fixed in two or three hours. I am an experienced mechanic, but instead of the three it took me nearer eight hours to fix the leakage. I removed seventy-two separate parts plus twenty-six lock washers—all to get at something that required fifteen minutes to repair. Nine of the capscrews were so located that at least five minutes was required to remove each and ten minutes to get each back and tightened properly.

No doubt there has been much experimenting done by automobile makers and designers to get various parts perfected so that a car will be turned out as nearly perfect as is mechanically possible, but I cannot help thinking that higher efficiency and more satisfied customers would be the result if greater efforts were taken to make some of the parts, now hard to get at, more accessible.

As a whole the automobiles of today are well designed and usually well built. But when you get one on the road, sooner or later you will find a weakness in some of the little parts that are seemingly unimportant, due to the lack of proper foresight of the designer. A slight change in shape or a different material, a curled edge or a rib added in the proper place to stiffen a weak spot, two or three screws added to the number holding a part in place or a next size larger screw would perhaps be the means of saving many dollars and hours of time for the owners.

A few repair jobs given to designers would possibly help a great deal in remedying the inaccessibility of many parts.

SEVEN CENTURIES of BRASS MAKING



By O. A. KENYON
ENGINEER, RAY D. LILLIBRIDGE, Inc.,
NEW YORK*

THE first step in placing the processes of the Bridgeport Brass Co. on a scientific basis was the organization of a research laboratory. To begin with it was necessary to make a research man out of every foreman in the plant, many of whom were technically educated men, thoroughly trained in research methods. Having organized the force, the processes were carefully developed and scheduled, and then it was necessary to provide an inspection laboratory to insure the standards that had been set up. Therefore, the laboratory work of the department may be divided into two parts, the research work and the control routine work. The research work divides itself into two general classes, namely: research work on products of the company and research work on materials and equipment employed by the company in the manufacture of its products. The control laboratory systematically samples the product at the various stages of manufacture and performs chemical analyses and certain physical tests, depending upon the nature of the product and the particular step in the process from which the sample was taken. In this way, it is possible to control closely the properties of the products passing through the plant.

The control laboratory is specially valuable in protecting the various alloys from any impurities there may be in the scrap used in their composition, and in this way serves as an accurate guide in the determination of the proportions of various kinds of scrap to be used in any given mixture.

The research department develops new alloys and studies details of the manufacturing processes, with a view to eliminating wastes and improving the quality of the product. It examines the fuel, lubricating oils and greases, the steel used for the dies and tools, and in many other ways develops and guards the manufacturing process in all its details.

The activities of this end of the business are far too numerous to be described in detail, but some idea may be obtained of the extent and character of the equipment from the illustrations shown herewith. Fig. 69 shows the electrolytic cells for determining the copper and lead content of brasses and bronzes as applied in the control testing of the chemical laboratory. The glass beakers are closed at the top with semi-circular pieces of glass, as may be plainly seen at the left. The girl in the center is washing off these plates so as to prevent any possibility of error, due to part of the solution clinging to the cover plates. The girl in the background is setting up a cell. The cells are operated from a special low voltage motor-generator set. Fig. 70 is a view in the balance room, where an important part of the control work is carried on. In the control laboratory every possible precaution is taken to avoid errors. The measuring devices shown in Fig. 71 are so constructed that an accurate quantity of liquid is measured automatically. All the operator does is to pump until the measuring column is full to the top. An internal tube, extending exactly to the upper graduation of the measuring tube, draws off the liquid automatically, leaving in the measuring tube the exact quantity required. Fig. 72 shows special electric furnaces for burning out filter papers. This is another improvement calculated to eliminate possible errors. It supplants the old method of open flame burner with the ever present possibilities of loss, due to drafts or accidental upsetting. Fig. 73 shows one of three micro-photographic machines. These machines are used both in control testing and investigation work. By means of systematic crystal

VI. Characteristics of Brass

Control of the quality of the product of a plant depends not alone upon the perfection of the mechanical apparatus used in its manufacture, but also upon an exact knowledge of the characteristics of the product, since they affect the operation of the apparatus. The characteristics of brass and the laboratory and research methods used to determine them are herein delineated.

(*Part V was published in the Dec. 16 issue.*)

*Booklet published by the Bridgeport Brass Co., Bridgeport, Conn.

FIG. 69. ELECTROLYTIC CELLS FOR DETERMINING THE COPPER AND LEAD CONTENT OF BRASSES AND BRONZES AS APPLIED IN THE CONTROL TESTING OF THE CHEMICAL LABORATORY

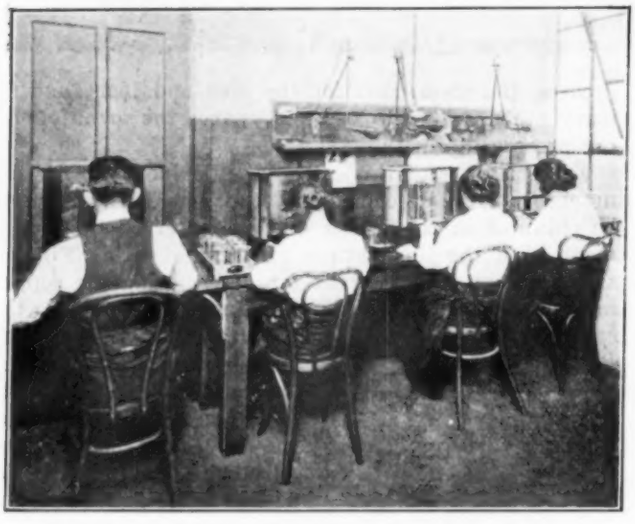


FIG. 70. A VIEW IN THE BALANCE ROOM

FIG. 71. AUTOMATIC LIQUID MEASURING DEVICES

FIG. 72. SPECIAL ELECTRIC FURNACES FOR BURNING OUT FILTER PAPERS

count, the standard of Bridgeport brass is maintained at every stage of the rolling and drawing processes.

Scleroscopes and Brinell hardness testing machines are used to test the hardness of the tubes and rod and sheet metal. A group of testing machines is shown in Fig. 74. In Fig. 75 is shown a conductivity bridge for routine testing of phono-electric wire and in Fig. 76 a machine for tensile and compression tests. Miniature melting and annealing furnaces for brasses and bronzes are shown by Fig. 77. A bar mold and various tools required for casting are shown in the center of the picture. The research laboratory also uses a miniature electric furnace for investigation purposes.

One of the most important elements in the successful manufacture of rolled and drawn brass is the lubrication of the working parts. This company has found it necessary to compound its own oils and greases for these purposes. The equipment shown by Fig. 78 is part of the oil laboratory in which formulas for compounding are evolved. Full testing equipment used for the inspection of fuels used in the power plant is illustrated by Fig. 79. The various furnaces are purchased to

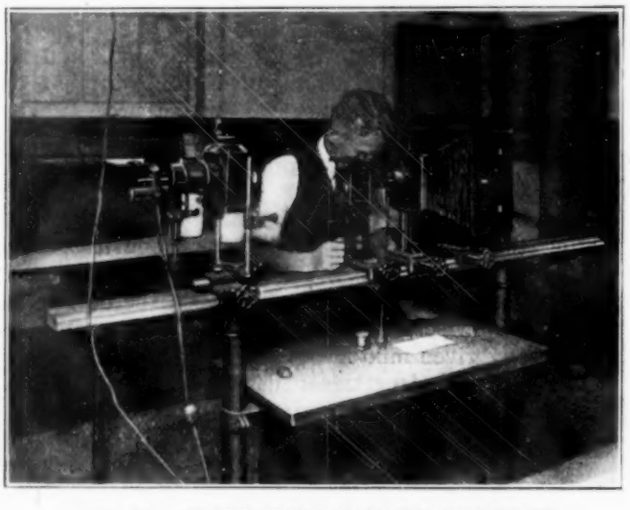


FIG. 73. MICRO-PHOTOGRAPHIC MACHINES

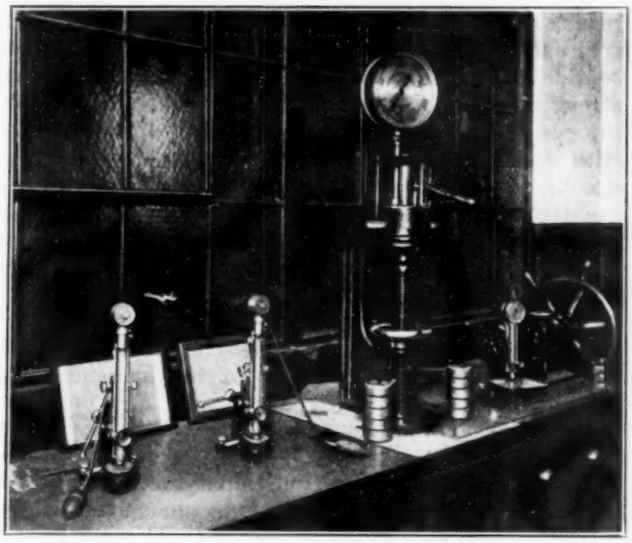


FIG. 74. A GROUP OF TESTING MACHINES

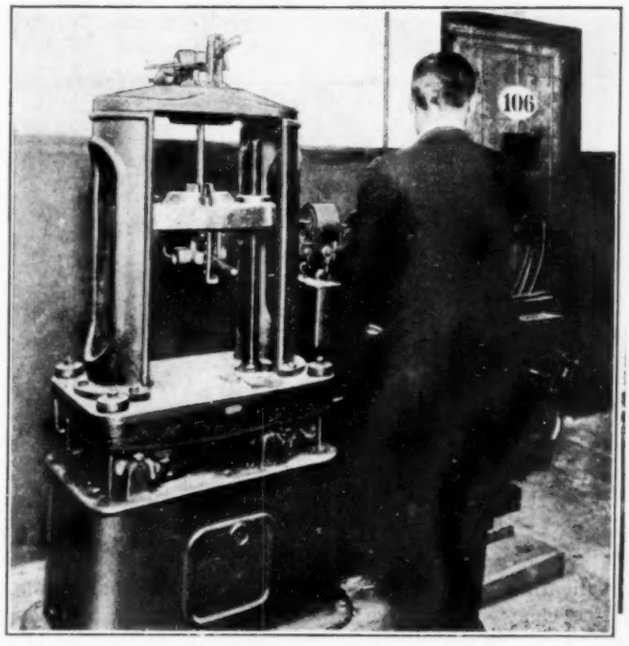


FIG. 76. MACHINE FOR TENSILE AND COMPRESSION TESTS

FIG. 77. MINIATURE MELTING AND ANNEALING FURNACE FOR BRASSES AND BRONZES

FIG. 75. CONDUCTIVITY BRIDGE FOR ROUTINE TESTING OF PHONO-ELECTRIC WIRE

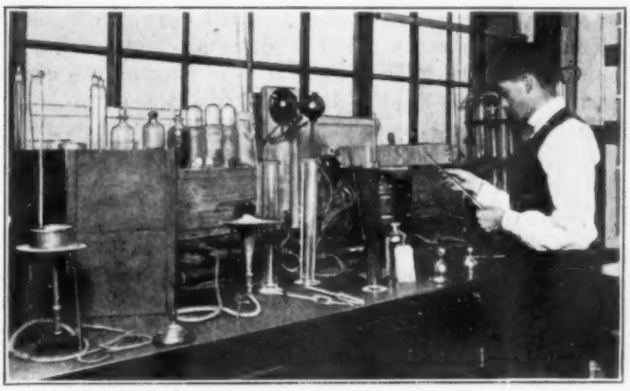


FIG. 78. PART OF THE OIL LABORATORY

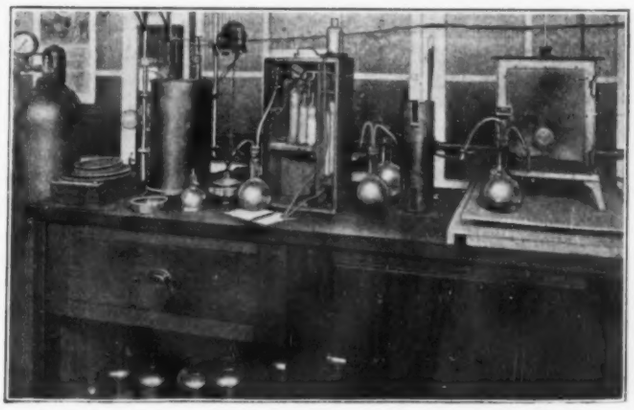


FIG. 79. FUEL TESTING EQUIPMENT USED FOR THE INSPECTION OF FUELS USED IN THE POWER PLANT

FIG. 80. ELECTRICAL APPARATUS FOR THE DETERMINATION OF CARBON CONTENT IN STEEL

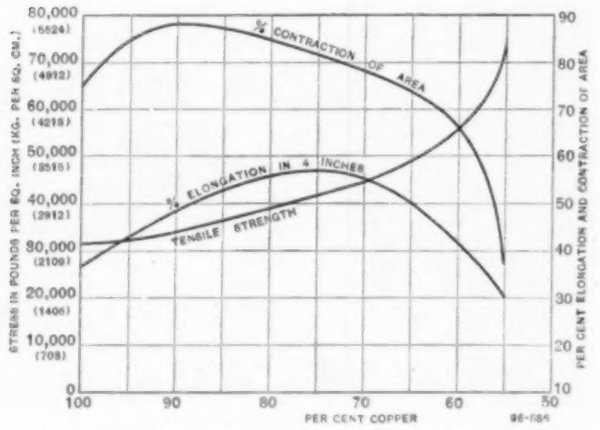

% CONTRACTION OF AREA
% ELONGATION IN 4 INCHES
TENSILE STRENGTH
STRESS IN POUNDS PER SQ. INCH (KG. PER SQ. CM.)
PER CENT ELONGATION AND CONTRACTION OF AREA
PER CENT COPPER
96-184

FIG. 81. RELATION BETWEEN PERCENTAGE OF COPPER AND ZINC AND THE PHYSICAL PROPERTIES OF BRASS

specification and carefully checked. Fig. 80 shows electrical apparatus for the determination of carbon content in steel. This apparatus is part of the equipment employed by the laboratory which controls the metals used for the various dies and tools in the mills.

Characteristics of Brass

The useful alloys of copper and zinc cover a series from about 55 per cent of copper and 45 per cent of zinc up to pure copper, and exhibit a wide range of normal properties and characteristics according to the proportions of the two constituents present. Their physical characteristics, when cold rolled and annealed, vary with the proportion of the two ingredients as shown in Fig. 81.

These curves were produced by plotting the results of tests on samples of sheet of various mixtures which had been rolled to 0.1 in. thick and carefully annealed at about 650 deg. C.

Brass Mixtures

Mixtures high in zinc are relatively unimportant because of their comparative lack of toughness which prevents their being readily worked cold. When containing less than 63 per cent of copper, however, they are readily rolled, forged or extruded, when hot. Within this range they are usually alloyed with other constituents for particular purposes. In the intermediate and lower ranges from 57 to 60 per cent copper, iron and tin are added, either singly or in combination, to the extent of about 1 per cent each, to increase strength, forming the manganese bronzes and naval brasses. The range from 60 to 63 per cent, combined with about 3 per cent of lead, covers the mixtures usually employed for making "leaded" or "free cutting" brass rod for screw machine use. From 63 to 70 per cent are the high brasses ordinarily employed in making sheet and strip; they constitute by far the greater part of all the sheet produced.

The mixtures containing the higher percentages of copper are necessarily more expensive and are required when color or certain qualities of toughness are important.

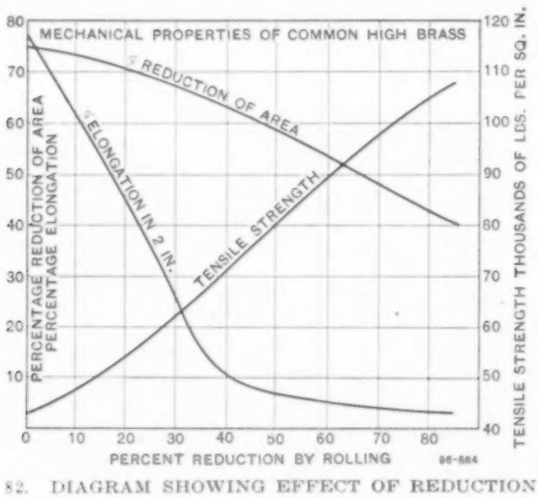

MECHANICAL PROPERTIES OF COMMON HIGH BRASS
% REDUCTION OF AREA
% ELONGATION IN 2 IN.
TENSILE STRENGTH
PERCENTAGE REDUCTION OF AREA
PERCENTAGE ELONGATION
TENSILE STRENGTH THOUSANDS OF LBS. PER SQ. IN.
PERCENT REDUCTION BY ROLLING
96-564

FIG. 82. DIAGRAM SHOWING EFFECT OF REDUCTION OF AREA UPON PHYSICAL PROPERTIES FOR BRASS OF A GIVEN COMPOSITION

Effects of Cold Working

The properties of any individual mixture may be varied over a wide range by varying the amount of cold working from the annealed state and by varying the annealing temperatures from the cold worked state. The relative effect which a given amount of cold working or degree of annealing produces varies with the proportion of copper and zinc present.

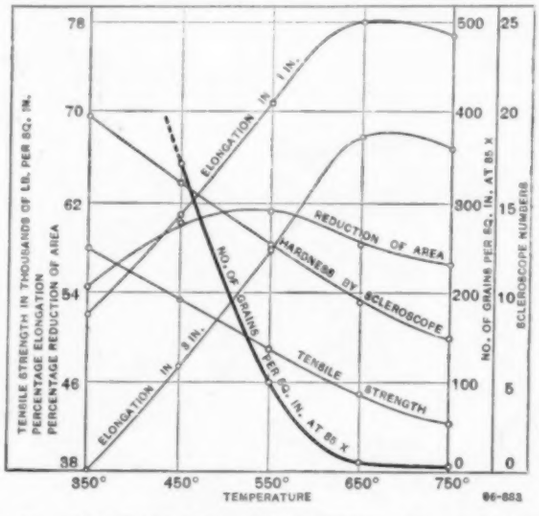

ELONGATION IN 1 IN.
REDUCTION OF AREA
HARDNESS BY SCLEROSCOPE
NO. OF GRAINS PER SQ. IN. AT 85 X
TENSILE STRENGTH
ELONGATION IN 2 IN.
TENSILE STRENGTH IN THOUSANDS OF LB. PER SQ. IN.
PERCENTAGE ELONGATION
PERCENTAGE REDUCTION OF AREA
NO. OF GRAINS PER SQ. IN. AT 85 X
SCLEROSCOPE NUMBERS
TEMPERATURE
96-883

FIG. 83. DIAGRAM SHOWING EFFECT OF ANNEALING TEMPERATURE UPON PHYSICAL PROPERTIES FOR BRASS OF A GIVEN COMPOSITION

The effect produced by a given amount of cold working is dependent solely upon the extent thereof irrespective of whether it is effected by a series of reductions or by one of the same total magnitude.

Effects of Annealing

In Fig. 82 is shown the effect of cold rolling on brass containing 67 per cent of copper. The percentage of reduction is the expression of the initial thickness minus the final thickness, divided by the initial thickness and multiplied by 100. Fig. 83 shows the effects of annealing a brass containing 67 per cent of copper and 33 per cent of zinc at varying temperatures. These values may be influenced somewhat by the degree of cold rolling to which the material has been subjected prior to annealing.

It is a usage of the trade to express the temper of cold rolled brass in terms designating the amount of reduction given in the final rolling after the last anneal, "1 number hard" or "quarter hard" corresponding to 10 per cent, "2 numbers hard" or "half hard" to 20 per

cent and "4 numbers hard" or "hard" to 40 per cent. Similarly the degree of annealing is somewhat roughly designated as light annealing, soft and dead soft, corresponding to about 500 deg. C., 600 deg. C., and 700 deg. C. respectively.

Additions and Impurities

The quality of copper ordinarily employed in brass is exceedingly high, containing 99.9 per cent or more of copper, the balance being largely oxygen, the presence of which is required mainly to enable the metal to be cast in suitable form.

Zinc is, however, obtainable in various qualities, the chief variable impurity in which is lead, which is found in various percentages from a few one hundredths up to as high as 2 per cent.

Lead

The quality of brass is affected to a considerable degree by the amount of lead carried by the zinc of which it is produced. The effect of this ingredient is to lower its toughness, ductility and ability to withstand cold working processes, involving stretching and distortion. The presence of lead also has a very marked effect upon the ease with which brass can be cut with a tool, and where this property is of importance, lead is purposely added in amounts up to 3 per cent or slightly over.

Iron

Next to lead the most important impurity carried by brass is iron, which is introduced partly with the zinc, in which metal it exists in varying quantities according to the grade of the latter, and also from accidental contamination when in the molten state. The effect of iron is to reduce ductility and increase hardness and its influence in these respects is markedly detrimental when present in quantities over 0.1 per cent.

Antimony and Bismuth-Arsenic

Other metallic impurities are seldom present in amounts sufficient to be detrimental, although antimony and bismuth, which are particularly objectionable, are usually carried in minute amounts by copper. Arsenic is sometimes present when grades of copper carrying that element are employed, but its effect, however, is ordinarily not pronounced and is useful rather than objectionable.

Tin

Tin is sometimes present by accident and sometimes by design. It increases the elastic limit and hardness of the material somewhat and acts as a deterrent to certain corrosive influences. Other elements are seldom found in the presence of good practice.

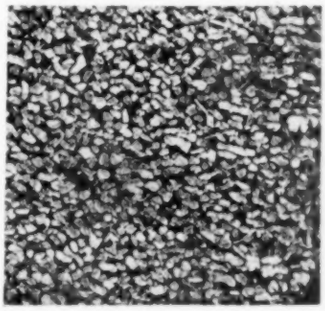


FIG. 84. SAMPLE FROM EXTRUDED ROD SHOWING MIXTURE OF ALPHA AND BETA CRYSTALS

Accurate knowledge of the physical properties of brass and the use of scientific methods in its manufacture have not heretofore been of sufficiently wide employment to have resulted in any generally accepted practice in specifying the qualities of brass required for specific uses or in testing it for the determination of its suitability. As a general rule, therefore, the largest measure of satisfaction can be secured when the brass maker is cognizant of the exact purpose for which material is to be employed and in close co-operation with the user can apply his knowledge and skill to the selection of mixture and treatment best adapted for the purpose.

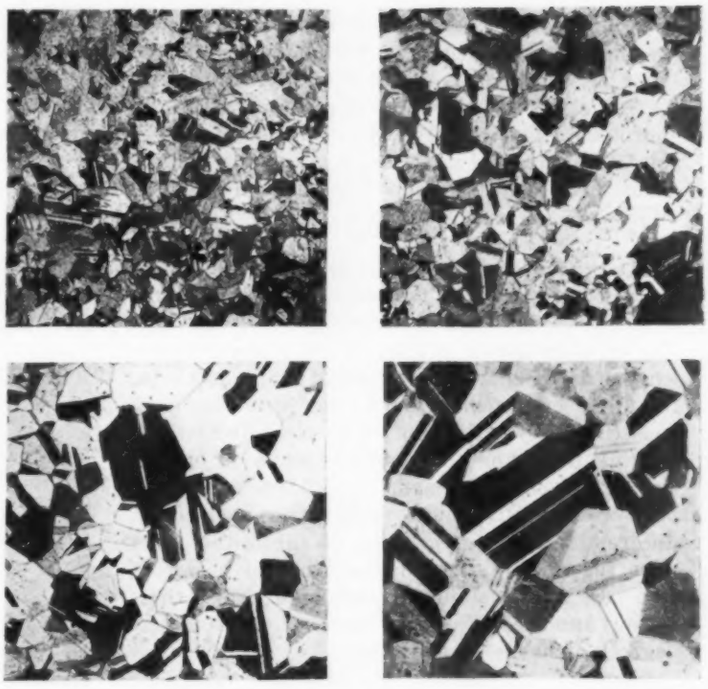


FIG. 85. MICROSTRUCTURE OF BRASS WHICH HAS BEEN ANNEALED AT VARIOUS TEMPERATURES. MAGNIFIED 85 DIAMETERS

The chemical, physical and research laboratories of the Bridgeport Brass Co. are, in equipment and personnel, second to none in their ability to determine and select the most suitable material for any particular usage.

Temper

It is equally important, however, that the temperature to which the material has been finally annealed, or the temper to which it has been rolled in case a temper is desired, be determined. The former may be ascertained by the ordinary tensile test, although on thin material this is somewhat uncertain. It may also be determined by microscopic examination as the size of crystal varies, as shown by Fig. 85, with varying temperatures of anneal.

The scleroscope and Brinnell tests are also useful in this connection. The latter in particular is applicable to relatively thick sections. For thin sheet the Erichson machine is very useful. This instrument employs a dome shaped tool to draw sheet into the corresponding shape. This drawing action is continued until fracture occurs. The depth of the cup at fracture, which is measured by the machine, is a measure of the ductility of the material. At the same time the smoothness or roughness of the drawn cup indicates roughly the size of the crystal structure.

Comprehensive attempts to draw specifications for various forms of wrought brass have not been conspicuously successful except in isolated instances. This

is because of the absence of reliable data of a specific nature relating the various properties of brass to the requirements of individual users. As indicated by the data heretofore given an enormously wide range of physical characteristics can be imparted to brass by variations in composition, heat treatment and manipulation.

Structure

The crystallic structure of brass is revealed by the microscope. The crystals are of two kinds, known respectively as the alpha and beta crystals. The crystals shown in Fig. 85 are alpha crystals, while Fig. 84 shows a mixture of alpha and beta, the light ones being the former and the dark ones the latter. Fig. 85 shows the effect which varying annealing temperatures have on crystal size in the case of a sample of brass which has been rolled quite hard and then annealed at different temperatures. Fig. 86 shows the effect upon the crystal structure produced by cold rolling. In this instance a sample of very thoroughly annealed brass has been rolled to several degrees of hardness as stated.

Some of the useful mixtures are composed entirely of alpha crystals, some of beta crystals and others of a mixture of the two. These crystals separate out of the molten brass as solidification occurs and exist singly or together in any particular mixture according to its composition and temperature. The alpha crystals are relatively weak and ductile; the beta are stronger and less ductile.

The equilibrium diagram, Fig. 87, shows the relations existing between the proportions of copper and zinc, the temperature, and the crystallic structure. The line *ABC* indicates the temperature at which, for various proportions of copper and spelter, solidification begins as a molten mass cools. The line *A* b_2 b_1 c_1 *C* shows the respective temperatures at which solidification is complete. It will be seen from this diagram that the presence of alpha or beta crystals is a function not alone of the proportions of copper and spelter present but of the temperature also. A brass containing 70 per cent or over of copper will consist only of alpha crystals, whereas one containing 65 per cent of copper will, when at a temperature of 700 deg. C. or over, contain some beta. If it is slowly cooled the beta will grow less as the temperature falls and finally disappear completely. If, however, it be rapidly cooled as by quenching in water there will be insufficient time for the latter transformation to take place and the presence of beta will be found upon microscopic examination. Similarly a brass containing 60 per cent of copper will, after high heating, contain all beta or a mixture of alpha and beta according as it is rapidly or slowly cooled.

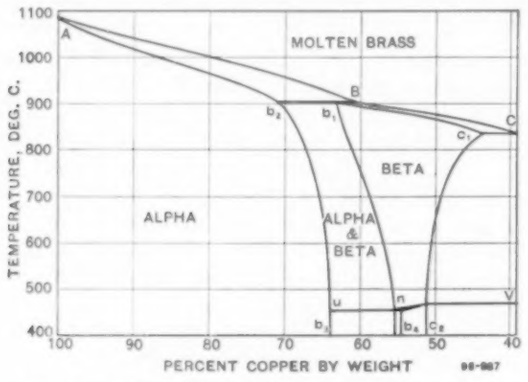


FIG. 87. EQUILIBRIUM DIAGRAM OF COPPER-ZINC ALLOYS

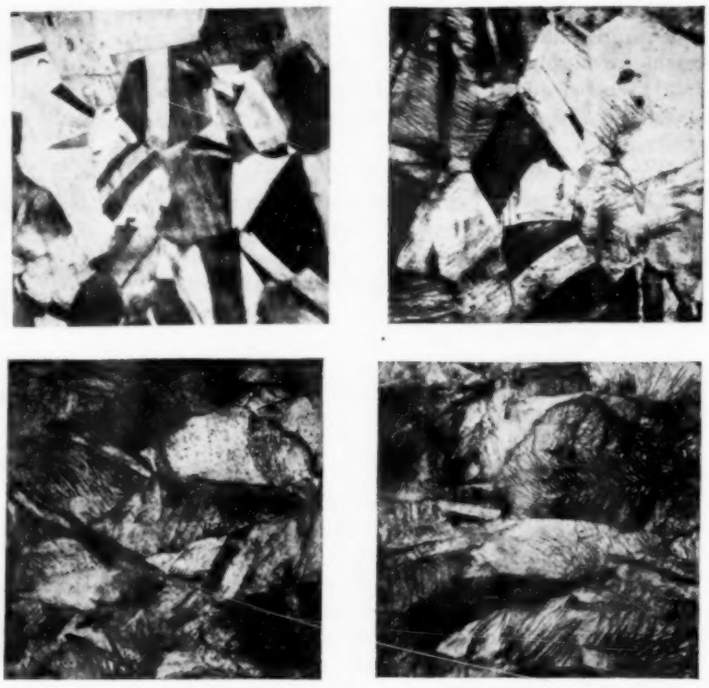


FIG. 86. MICROSTRUCTURE OF BRASS WHICH HAS RECEIVED VARYING AMOUNTS OF COLD ROLLING. MAGNIFIED 85 DIAMETERS

The Relation Between Brinell Hardness and the Grain Size of Annealed Carbon Steels

In Scientific Paper No. 397, issued by the Bureau of Standards, Washington, D. C., are given the results of a study of the relation between the Brinell hardness and the grain size of annealed carbon steels, made by Henry S. Rawdon, physicist, Bureau of Standards, and Emilio Jimeno-Gil, professor of Physical Chemistry, University of Oviedo, Spain. The general plan of study included the determination of the hardness of specimens which were of the same composition but widely different in grain size. Two methods were used to develop grains of different sizes, one being slow cooling after heating in a furnace, the other consisting of annealing bars which had been given a cold working by stretching in tension. Each specimen was examined microscopically and a grain-size determination attempted. The Brinell hardness was determined in two different ways.

The results of the experiments show that no simple and direct relation exists between the grain size and the Brinell hardness number for carbon steels, although a very pronounced increase in grain size is usually accompanied by a decrease in hardness. No appreciable difference in hardness number was observed between groups of small crystals and the large ones of the same specimen. The general effect of heating steel was to harden it appreciably. The rate at which steel is cooled affects the hardness much more than any other factor, because of the effect on the structural condition of the hardening constituents. The change in grain size is often very abrupt, the crystals growing rapidly with but small increases in temperature, which is above the Ac_2 transformation point.

Slotting-Machine and Planer Toolholders for Railroad Shop Use

By Frank A. Stanley

The halftone and the line drawing, Figs. 1 and 2, show the construction of a heavy-duty adjustable slotting-machine toolholder with backstroke release. The shank or body of this holder which is turned down at the end to 3½ in. in diameter is threaded to eight threads per inch to receive the internally threaded split sleeve *A*, Fig. 2. This sleeve also fits to the threaded shank of block *B*, and thus connects the latter with the bar or shank. The block *B* is made to carry the cast-steel head *C* which is planed out across the upper end to provide jaws to fit over the rectangular lower portion of *B*. Here head *C* is mounted in place by means of a taper pin upon which it rocks when in operation.

The method of attaching the carrier to the body by means of the sleeve *A* allows the toolhead to be adjusted around at any desired angle and securely clamped when once set. The sleeve is not only split vertically to permit of its being gripped tightly to the threaded members which it incloses, but it is further cut horizontally well into the bore at a point midway of its height and two independent clamp screws are provided so that the lower portion may be released upon the toolhead and the latter readjusted without loosening the upper half and its grip upon the threaded end of the holder; or the upper adjustment may be made without necessarily loosening the clamp on the toolhead.

The toolpost *D* slides into a 2-in. cylindrical bore at the bottom of the head *C* and the tool is clamped by the nut which draws the post up and binds the slotter tool against the upper side of the rectangular tool slot. The head is held forward in normal position by a compres-

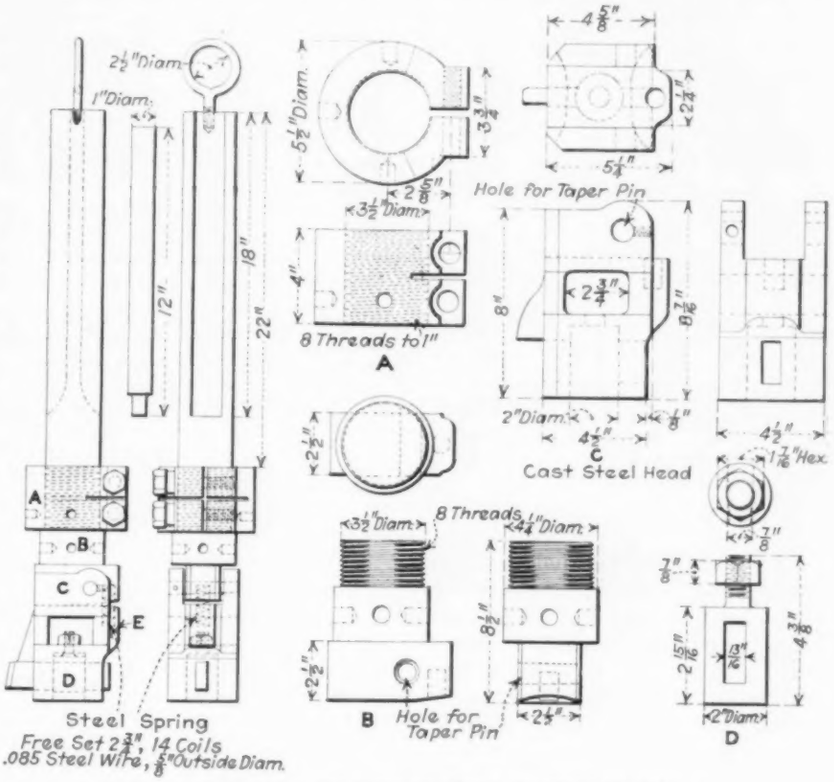
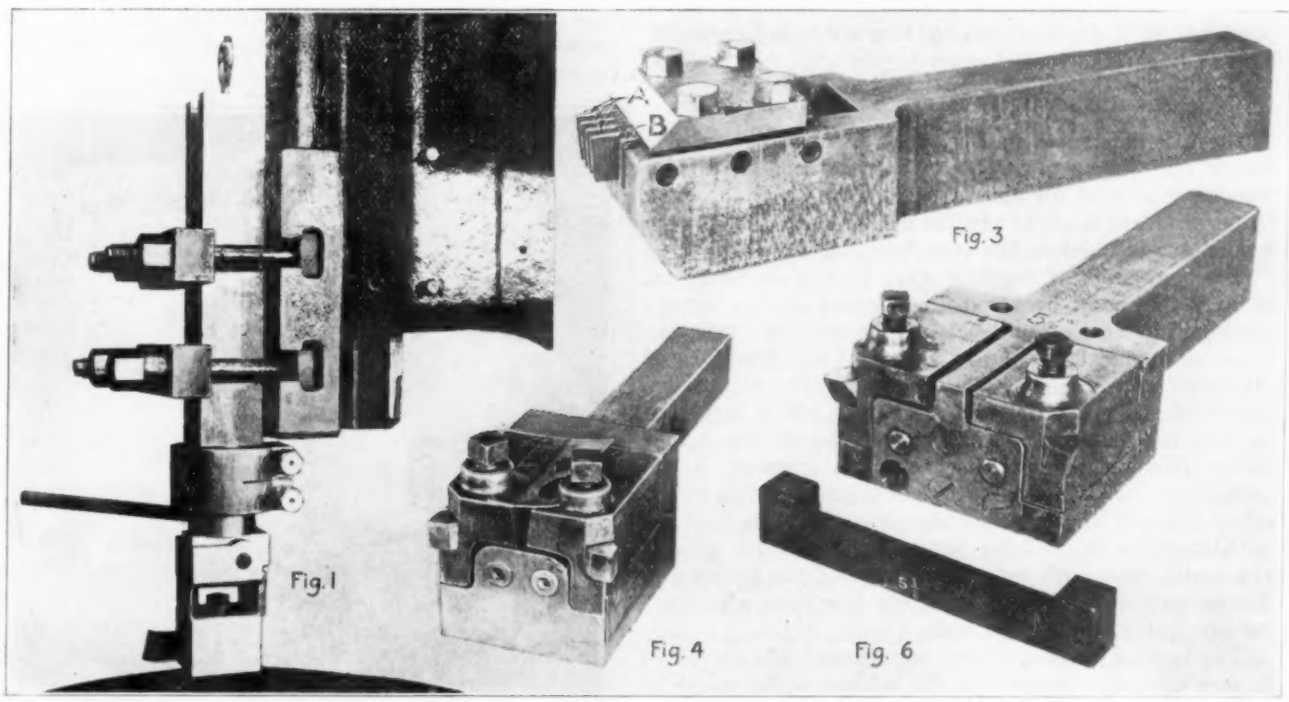


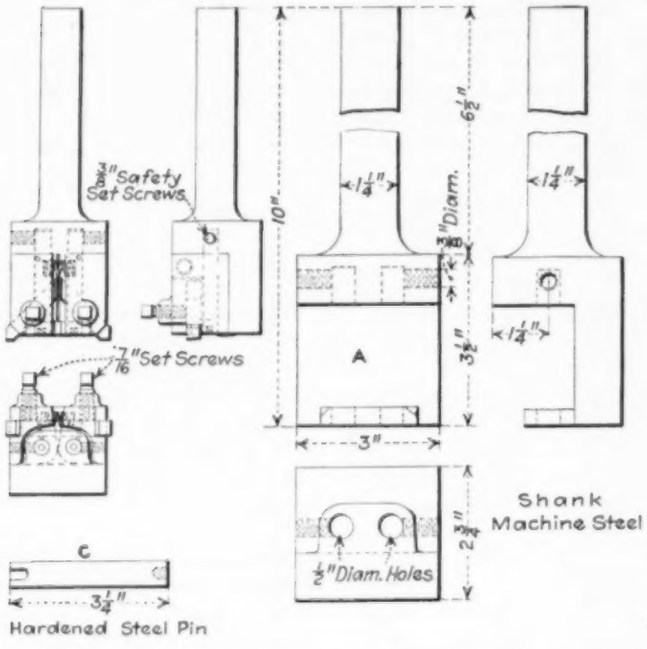
FIG. 2. DETAILS OF TOOLHOLDER SHOWN IN FIG. 1.



FIGS. 1 TO 6. THE SLOTTING-MACHINE AND PLANER TOOLHOLDERS

Fig. 1—Heavy-duty adjustable slotting-machine toolholder with back-stroke release. Fig. 3—Planer tool for cutting reverse lever slots in foot bar. Fig. 4—Adjustable shaper toolholder with back-stroke release. Fig. 6—Planer toolholder for finishing both sides of crosshead slot for gib in one operation.

sion spring *E*, ⅝-in. outside diameter by 2¾ in. long free set. The spring is of 0.085-in. steel wire.



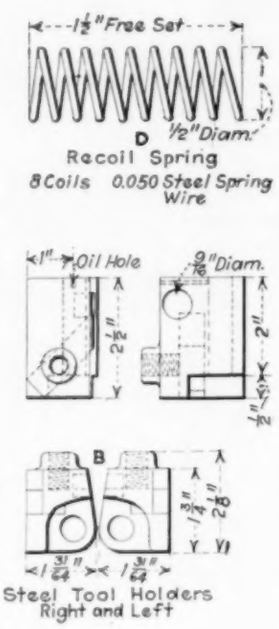


FIG. 5. DETAILS OF TOOLHOLDER SHOWN IN FIG. 4.

A gang planer toolholder is shown in Fig. 3 and is made for cutting reverse lever slots in foot bars. This toolholder carries four cutting-off tools *A* of high-speed steel which are beveled or cleared from the top thickness of 7/16 in. to ⅝ in. at the bottom. They are separated or spaced by tool-steel filler blocks of the same degree of bevel. The thicker filler block *B* at the outside of the group of tools takes the pressure of the three side clamping screws which have hollow heads and which are set in flush with the outside of the holder. The top of the holder is fitted with a half-inch tool-steel clamp plate which is drawn down by four ½-in. capscrews to grip and seat the tools firmly.

An Adjustable Shaper Toolholder

The tool illustrated in Fig. 4 is a back-stroke release holder for shaper tools. It is adjustable and its two tools may be used for openings from 3½ to 3⅞ in. wide. Other sizes are made in similar designs. Details of this holder are covered in the line drawing, Fig. 5.

The body *A* is of machine steel with a shank 1¼ in. square, the body proper being shaped like a screw-machine box tool. The blocks which hold the tools are made right and left hand as shown at *B*. They are of steel with ½-in. holes finished through to receive hardened and ground steel pins *C*, upon which they rock to give the relief upon the back stroke of the shaper ram. This recoil or release action is opposed by the coiled spring *D* which is seated in opposing holes in the inner faces of the two tool blocks so that the two are acted upon with uniform pressure. The pivot pins *C* are seated with both ends in the body of the holder and are secured in place by ⅜-in. safety setscrews which are set up against their inner ends.

The cutting tools are ½-in. square and are placed in square openings formed in the holders at an angle of 45 deg. When adjusted, the tools are secured by 7/16-in. setscrews tapped in through the top of the holders. The small oil holes near the rear ends of the tool blocks enable the pins to be properly lubricated so that the holders can operate freely upon their pins.

A tool of somewhat similar design but made for use in the planer is illustrated in Fig. 6. This has a cutting width over the tool points of 5½ in. and is used for finishing both sides of crosshead slots for the gib in one operation. The toolholders proper have the same relief action as in the case of the smaller size just described. The ends of the pins upon which the holder blocks rock are seen at the front of the device. The coil springs are barely noticeable in the photograph. The gage seen in the foreground is used for setting the two tools to proper width for the slot to be finished.

The tools illustrated in this article were designed and made at the Southern Pacific Railroad shops, Sacramento, California.

Frame Welding Apparatus in Railroad Shop

By Frank A. Stanley

The collapsing forge and the special power hacksaw shown in the illustrations herewith are used for welding operations on locomotive frames at the Southern Pacific shops at Sacramento, Cal. The forge is used in connection with fuel oil burners which are introduced through the openings in the front. The forge walls are built up of fire brick and held together while in use by the angles at the corners, through which are introduced tie rods with nuts at the ends.

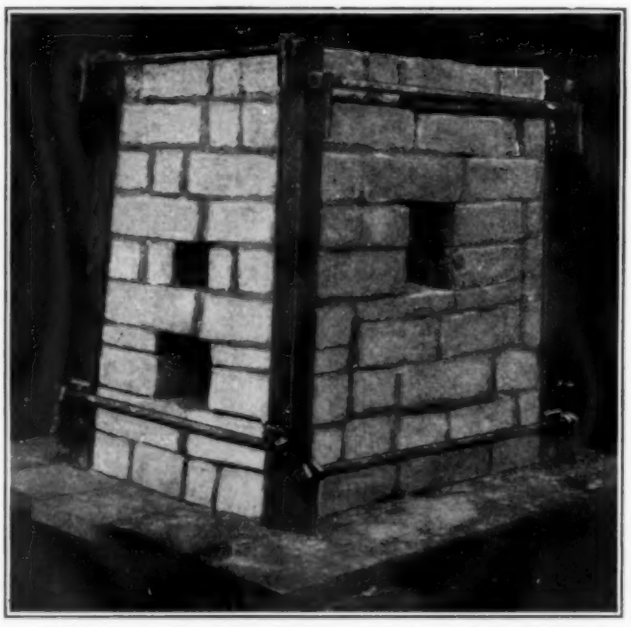


FIG. 1. COLLAPSING FORGE FOR LOCOMOTIVE FRAME WELDING

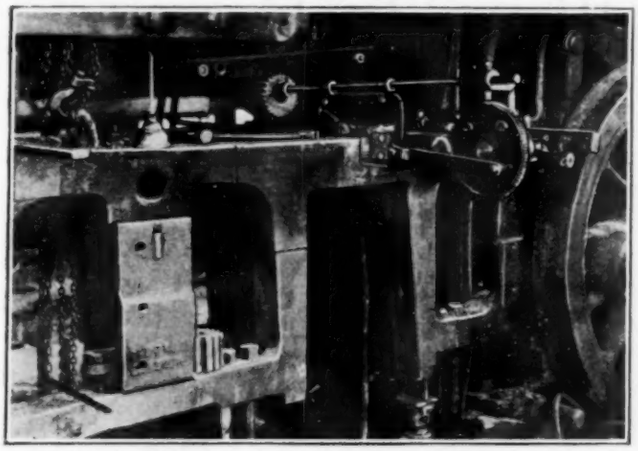


FIG. 2. SPECIAL POWER SAW USED ON A ROUNDHOUSE JOB, PREPARING FOR OIL WELD

The forge is built up around the portion of the frame requiring repairing by welding. It is used either in the roundhouse or at the shop pits. Before welding, however, the frame is operated on by the power sawing machine seen in Figs. 2 and 3. In the first of these views the sawing machine is shown on a roundhouse job cutting through the top of a locomotive frame, while in Fig. 3 a similar machine is seen in operation on the side of a jaw with the same blade cutting horizontally instead of in the customary vertical direction.

The Saw Arrangement

The sawing machine is made up of a special frame mounted upon a bracket which carries also the shaft for the main driving gear. This gear is connected with and driven by a small gear operated by the spindle of an air drill motor, which in Fig. 3 is shown supported upon a block directly under the saw frame. The gear reduction is about six to one, giving a speed rate sufficiently low for satisfactory operation of the saw.

The saw is used to cut through the frame at the point where a crack may have occurred and thus a clean square surface is secured for the welding of the joint. After the frame has been thus cut a piece of Norway iron, say 1 in. thick, is placed in the opening. The forge is then built up around the work, the fire brick openings being left at whatever points are required for clearing the frame members, for introducing the heating apparatus and for the heavy air hammers that are used in welding the job. Building up the collapsing forge and heating the joint is usually done in less than a couple of hours. With the welding iron in place and the work heated to welding point, the frame is drawn up taut to close up the inserted metal in the joint to, say, about $\frac{1}{16}$ in. thick by means of heavy through bolts and clamps applied to the frame sides, and as the clamps are tightened gradually the work is acted upon at each side by heavy air hammers applied through the openings at opposite sides of the forge. Usually an allowance of $\frac{1}{16}$ in. in the work is left for shrinkage as the frame cools off after welding.

The collapsing forge and saw outfit have been used with the greatest success on a large number of jobs of this character.

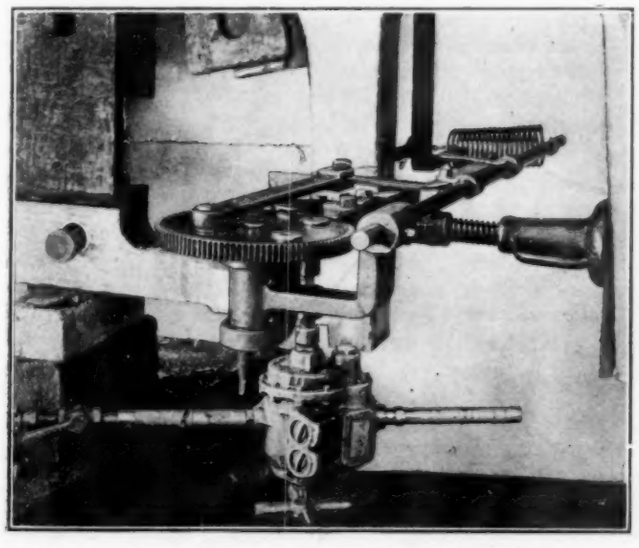
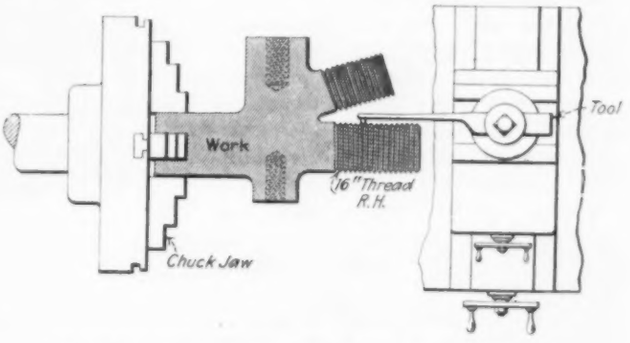


FIG. 3. POWER SAW CUTTING SIDEWISE THROUGH LOCOMOTIVE FRAME, PREPARING FOR OIL WELD

Emergency Method of Cutting Thread

By Richard H. Kiddle

We recently had occasion to cut a thread on a brass casting of such shape as to require a thread tool the reverse of the one commonly used to cut inside threads.



EMERGENCY METHOD OF CUTTING A THREAD

We had but one casting, so to save the time of forging a new tool we simply ran the lathe backwards and used the regular inside tool. The sketch shows the shape of casting.

A Veteran of Three Wars

By Thomas L. Stephen

Referring to the article entitled "Veteran of Three Wars," which appeared on page 1032 of the *American Machinist*; we have read the article with considerable interest and have been making some investigation among our old records covering Putnam tools.

From the illustration, there would appear to be some Putnam characteristics on this lathe, particularly with respect to the headstock, tailstock, bed, and compound slide. The carriage is, however, unlike anything that Putnam ever made. The T-slots in the wings of the carriage run parallel to the toolslide and this is a feature which Putnam never approved. If the carriage shown is the one originally sent with the machine (and, of course, no one knows whether this is so or not), then the machine is not a Putnam product. While the writer is not so intimately acquainted with the older builders of large lathes, he is rather of the opinion that the New Haven Machine Co. may have been the manufacturer of this sturdy veteran.

Machining Large Water Turbines

By FRED H. COLVIN
Editor, *American Machinist*

As nearly all of the water turbines turned out by the Pelton Water Wheel Co., San Francisco, Cal., are designed for specific duties, almost every wheel becomes a special job, often taxing both the capacity of the machine tools and the ingenuity of the executives and men to an unusual degree. The difficulties of this work, however, make it extremely interesting as can be seen from the accompanying illustrations.

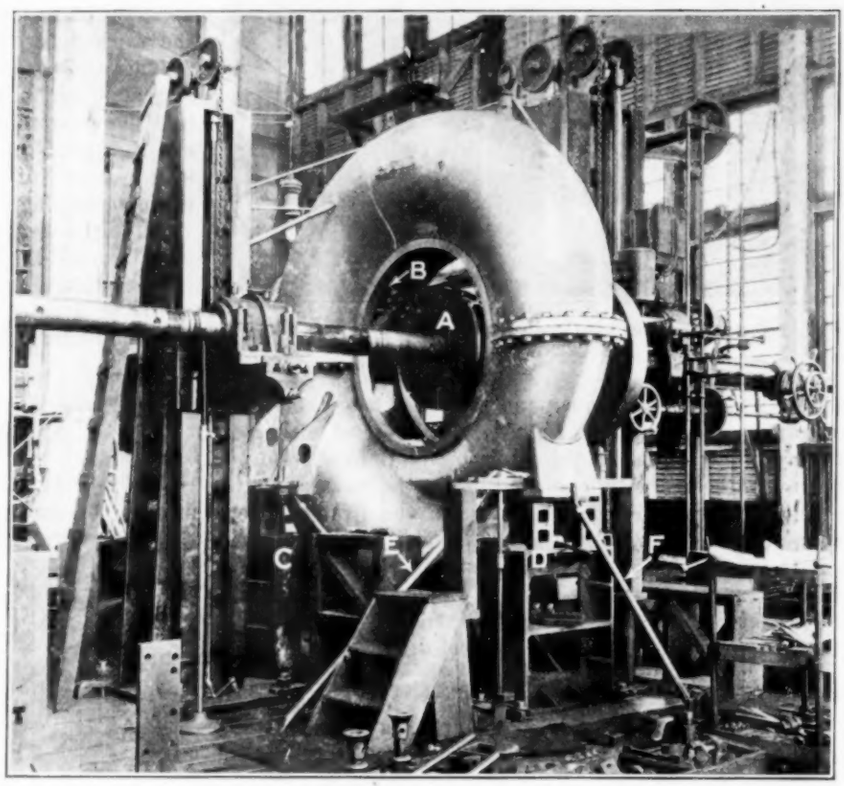


FIG. 1. A 14-FT. HORIZONTAL BORING MACHINE AT WORK

TO ONE who is accustomed to work of comparatively small size and to production in such quantities as to warrant the designing and building of elaborate special fixtures and machines, the problems presented in the manufacture of large Pelton water wheels or turbines must seem nearly insurmountable. Both the executives and workmen of the Pelton shop are, however, accustomed to work of this kind and to solving difficult machining problems. A few examples of turbine work are illustrated herewith and are particularly interesting on account of the way in which both the work and the machines have been handled to accomplish the desired results.

In Fig. 1 is shown the casing of a good-sized turbine being bored and faced on a 14-ft. floor-type boring mill. The hole being bored is about 36 in. in diameter, the boring head being shown at *A* and the boring tool at *B*. The method of blocking up a heavy casting of this kind can be seen at *C* and *D* while the type of adjustable angular brace is shown at *E* and *F*. Details of the bor-

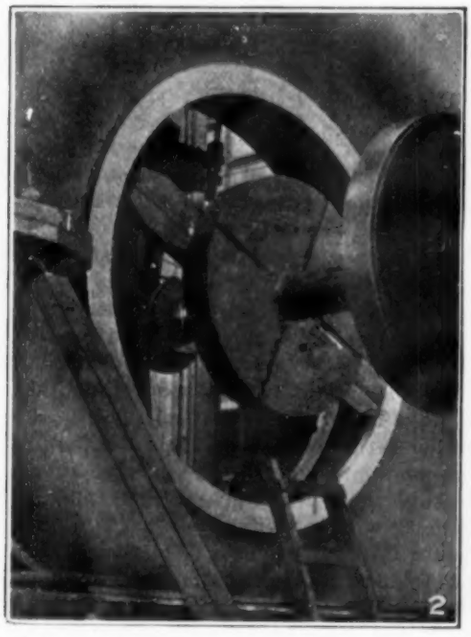


FIG. 2. DETAIL OF THE CUTTER HEAD

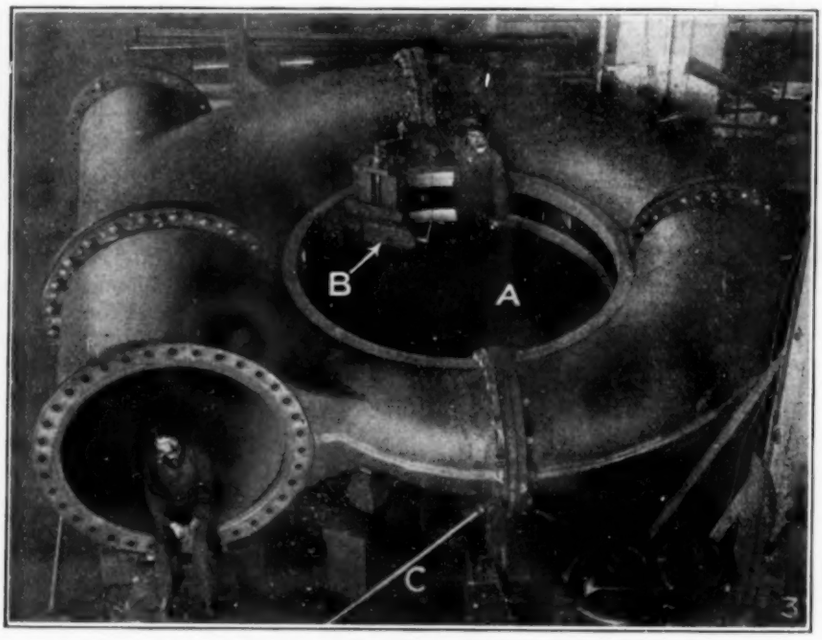


FIG. 3. BORING AND FACING A 9-FT. HOLE

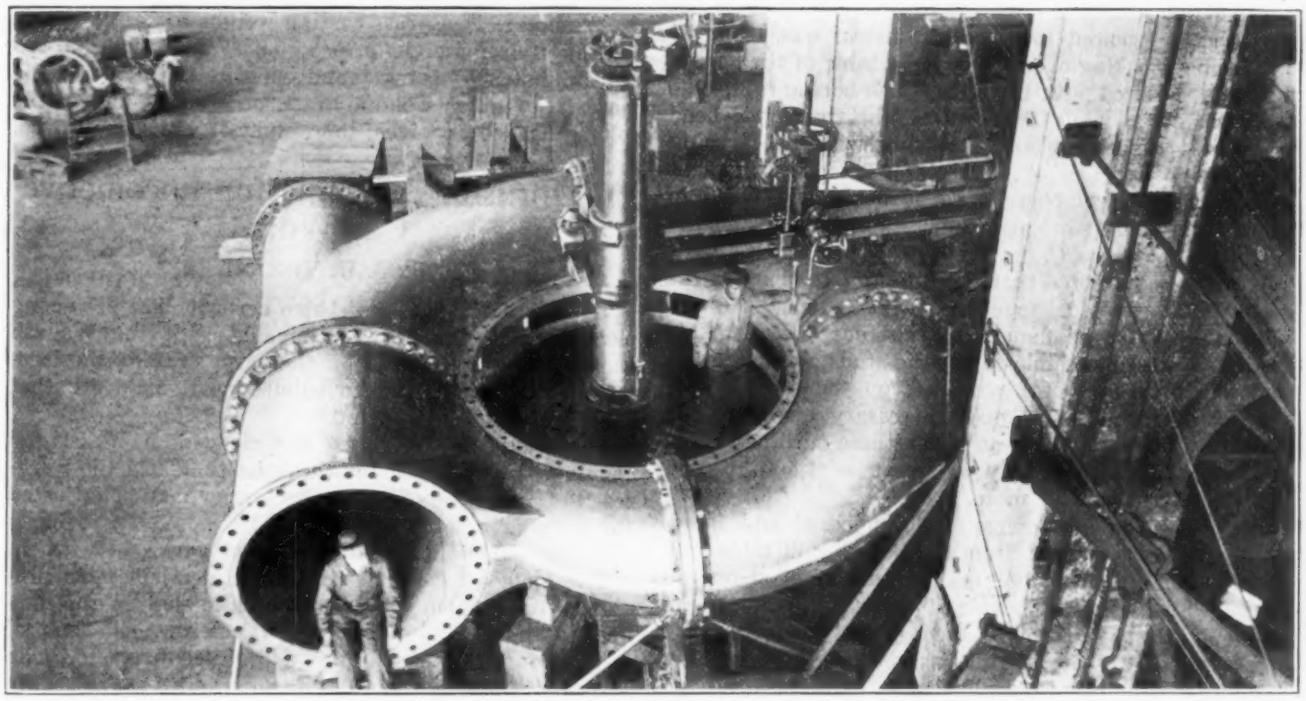


FIG. 4. RADIAL DRILLING ON A BORING MILL TABLE

ing head are shown in Fig. 2, which is taken from the other side.

An unusual and interesting job, shown in Fig. 3, is the boring of a 20,000-hp. cast-steel turbine casing having an internal diameter of approximately 9 feet. As it was impossible to swing this casting on the boring mill table, as well as not being feasible to handle it in the same way as shown in Figs. 1 and 2, an entirely different method was devised and put into practice. The housings and cross-rail of a large vertical boring mill were removed from the base, leaving only the table and its driving mechanism. Then the casing with the

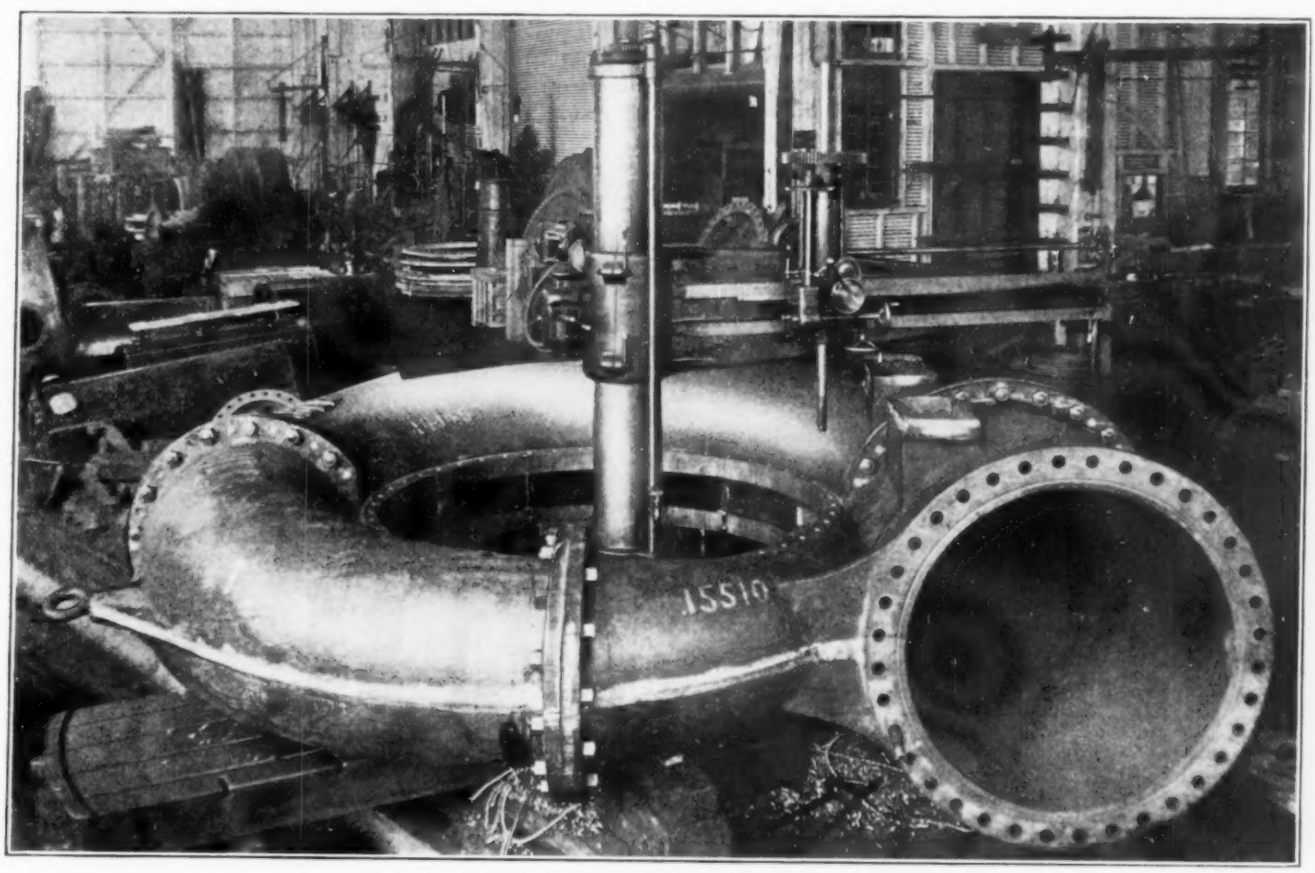


FIG. 5. ANOTHER METHOD OF RADIAL DRILLING

four sections bolted together as shown, was mounted on suitable blocking over the bed and table of the boring mill, and centered with the table. The boring mill table is shown at *A*, while *B* shows a substantial tool head mounted on the table and revolving with it, carrying the cutting tool as it revolves. This arrangement enabled the central opening to be bored and faced in good time. This view also shows the blocking and the use of the braces at *C*.

It will also be noted that the different sections of the casing are bolted together with studs screwed alternately into the flanges of the four pieces. This method makes it possible to get the studs close together and still have room for wrenches on the nuts. Close spacing of the studs is made necessary owing to the extremely high pressures at which these turbines work, the head being frequently as great as 1,500 ft. and occasionally somewhat more.

After the center opening has been bored and faced, the toolhead is removed from the boring mill table, and the column of the radial drilling machine, shown in Fig. 4, is bolted to the center of the table. The column is simply removed from its base, picked up by a crane and lowered into the opening as shown. The blocking remains the same as before.

A somewhat different method of drilling another turbine casing is shown in Fig. 5. Here a complete radial drilling machine is picked up by the crane and the base threaded through the center of the casing, or the column removed and replaced as the case may be. The illustrations show some of the different expedients which it is necessary for a shop of this kind to use and which relieve the work of any tendency toward the monotony usual in mass production.

At the time of my visit there were in process of construction six units of 15,000 hp. each, for Japan. The cases for these units, owing to the water to be used, had to be lead lined which was considerable of an undertaking. The turbines were to run at 300 r.p.m. which gives a peripheral speed of about 200 ft. per second.

Conversion Factors for Weights of Metals

BY CHESTER E. JOSSELYN

The usual method of obtaining weights of similar castings necessitates the use of a calculation of the following sort: $\frac{0.26 \times 5.75}{0.31} = 4.8225$, when a brass casting weighs 5¾ lb. and it is desired to know its weight if it were iron. The 0.26 and 0.31 are weights per cubic inch of cast iron and of brass, respectively. By use of the constant multipliers given in the table the work can be simplified, the multipliers being obtained by dividing the unit weight of the desired material by that of the given material.

The use of the table may be illustrated by means of an example: If a brass casting weighs 5¾ lb., the same casting of iron weighs 5.75 × 0.8387 = 4.8225 lb., the multiplier 0.8387 being found opposite the name of the material of given weight, brass, on the left and in the column headed cast iron, the weight of which is desired.

TABLE SHOWING RELATIVE WEIGHTS OF METAL.

Material of given weight	Multipliers for weight of desired material				
	Cast Iron	Steel	Brass	Lead	Aluminum
Cast Iron	1.	1.0769	1.1923	1.5769	0.3461
Steel	0.9285	1.	1.1071	1.4643	0.3214
Brass	0.8387	0.9032	1.	1.3225	0.2903
Lead	0.6341	0.6829	0.7561	1.	0.2195
Aluminum	2.8888	3.1111	3.4444	4.5555	1.
Weights per cubic inch	0.26	0.28	0.31	0.41	0.09

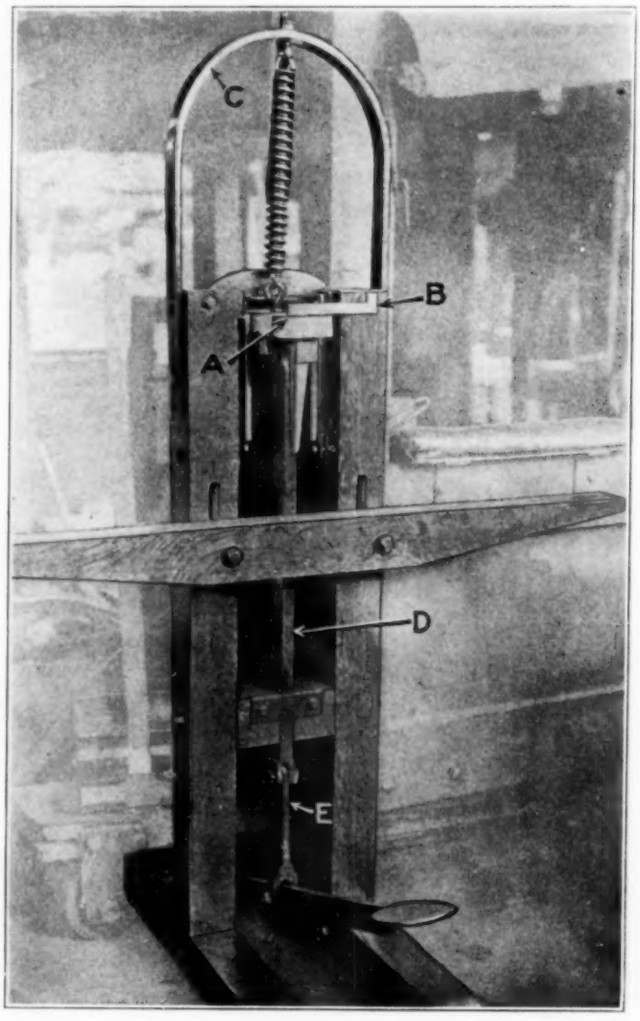
A Mortising Machine for Locomotive Cab Work

BY J. H. VINCENT

The mortising machine shown herewith has been completed recently in the Decatur shops of the Wabash Railway Co. It is used by the carpenters of the locomotive cab department to handle mortising work that was formerly done by hand.

The frame and workrest are made of oak. Slotted openings are provided for the bolts that hold the workrest to the uprights so that the former may be adjusted for varying heights of work. The mortising toolhead slides on guides made from steel forgings.

The toolhead *A* carries a special mortising tool provided with a handle *B* that drops into slots in the toolhead; these slots, together with a setscrew, hold the tool in position when turned to face in either direction. The arched steel bar *C* above the frame carries a coil spring that sustains the weight of the toolhead and connecting rods *D* and *E* and lifts them after each stroke of the foot-lever.



MORTISING MACHINE WITH WOODEN FRAME

Machining Railroad Cross-Ties*

By D. W. EDWARDS
Greenlee Bros. & Co.

The author tells of the recognition of the economic importance of prolonging the life of railroad cross-ties by increasing their resistance to mechanical wear and decay. The necessity of certain machining operations is explained and the operations, together with the machines required for them, are described. Both portable and stationary systems are considered.

THE cost of railway-track maintenance has vastly increased in recent years and one of the largest single items of expense involved in this work is the cost of cross-ties. Not only is their cost increasing with the diminishing supply of the most suitable timber and the growing scarcity of labor, but their life when unprotected grows shorter because of the greater destructive effects of heavier wheel loads and more frequent trains. Also the labor cost of renewing ties, exclusive of the value of ties themselves, has advanced.

A consideration of these facts leads to the conviction that there is no department of railway administration in which there is such an opportunity for large saving as in the field of tie conservation. It is encouraging to observe that the number of plants for the chemical treatment of ties is constantly increasing, heavy tie plates are coming into more general use, and a growing appreciation of the importance of improved rail fastenings is apparent.

Two Causes of Tie Deterioration

There are two causes of tie deterioration, decay and mechanical wear, and there is no economy in increasing the resistance to one without also increasing the resistance to the other. In some localities decay proceeds more rapidly than mechanical wear, and in arid sections ties wear out before they decay, but as an average the two destructive agents may be considered of practically equal importance.

It is evident that efficacy of treatment can be realized by doing all cutting before the treatment takes place so that the chemical may present an unbroken barrier to the attacks of decay spores. The majority of all ties are so winding or crooked that they should be adzed to secure proper bearings for the rails, but to do this after treatment is folly as it nullifies the effect of the treatment at the points where it is most needed, around the rail fastenings.

Smooth, safe and durable track demands the equal distribution of the load over all ties. This result can be obtained only by providing a perfect and equal bearing for each rail on every tie. By so doing it is possible to eliminate half-moon breaks in rail bases, to greatly reduce rail cutting and to lower the labor cost for upkeep, because surface is more easily maintained. This can be done accurately only by a machine designed for the purpose. It cannot be satisfactorily done by hand adzing.

Tests made by the United States Bureau of Forestry, and independently by many railway companies, show that the holding power of common square spikes is increased by driving them into previously bored holes of suitable size. The resistance to transverse flange pressure is also increased because the spikes have a backing in the solid wood and not against the torn and distorted fibers. When the spikes are driven into bored holes the gage is better maintained, respiking is less often necessary and the ties are not so soon spike-killed.

Where ties are to be treated it is essential that they be bored for the spikes before treatment as the holes permit the chemical to enter the interior portion of the tie. When the spikes are driven there is no possibility of the grain of the wood being opened to moisture beyond the penetration depth. The elimination of decay around the spikes removes the most fruitful cause of the necessity for tie renewals. A lighter total treatment will give the same or better results because the effect is concentrated where most needed.

That ties are frequently terribly mutilated through driving cut spikes directly into them without boring is clearly illustrated in Fig. 1. Although the saving of putting machined ties in track is slight in proportion to the total return thus gained, this alone is sufficient to pay the cost of the adzing, boring and trimming operations.

Importance of Trimming

Trimming off the ends of ties by means of cut-off saws exposes internal decay which is not otherwise apparent because of the weather-hardening of the ends. A considerable percentage of ties is so decayed internally as to be of little value and these may be thrown out before the cost of treatment has been expended upon them. This raises the average grade of the ties put in track and gives more uniform service. Trimming also increases the absorption of the chemical by the removal of the refractory case-hardened end surfaces.

Recently a quantity of short ties was required in a tunnel project. More than twice the number were taken

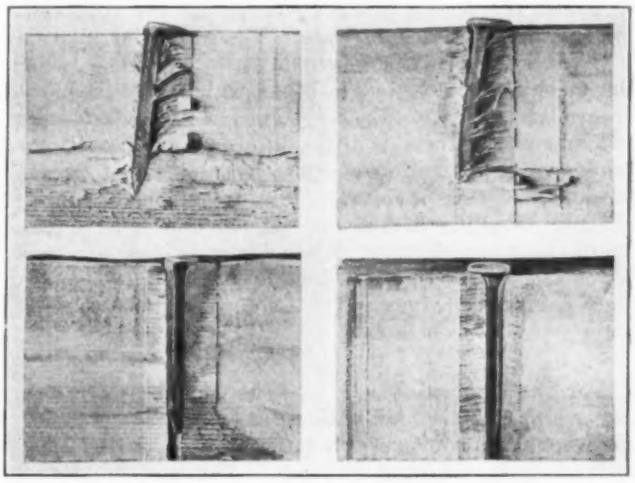


FIG. 1. CROSS-SECTIONS OF TIE SHOWING EFFECT OF SPIKES DRIVEN WITH AND WITHOUT BORING

*Presented at the Annual Meeting, New York, December, 1920, of the American Society of Mechanical Engineers.

from apparently sound ties before a sufficient quantity that actually were sound were obtained. In another instance 640 ties were rejected after trimming from a lot of 3,000 ties of perfectly good outward appearance, which goes to prove that it not only pays to trim the tie ends for inspection of their internal state of preservation but that in that manner only can their true state be discovered. That an unsound tie should not be treated or put in main line track is beyond argument.

Why Ties Are Adzed

Briefly, ties are adzed to assure perfect rail-plate bearing; bored to permit chemical penetration, provide correct gage and perfect spike support; and trimmed for appearance and inspection. That the trimming operation is of the utmost importance and worthy of serious consideration cannot be too greatly emphasized.

It has been almost universal practice on the English and many other European railways to machine their ties before attaching the rails or rail chairs to them. The consensus of opinion there is to the effect that such preparation by machining is of marked economy. Years of observation, and tests on both treated and untreated ties, have proved that longer life is obtained by the machining operation.

American railroads that have assisted in the development of machines for adzing, boring and trimming ties believe that great economy in track maintenance is derived through their use. Every road that has made an installation of equipment of this character, after a period of practical tests through use of machined ties, has added to its original plants, and is endeavoring as rapidly as possible to provide for machining all ties used in main-line track.

The operations performed on machined ties are trimming, adzing, boring and branding. Standard machines, developed through ten years of more or less experimental work, are now on the market and a great many installations are in successful operation in various tie yards throughout the United States. The trimming, adzing, boring and branding machines are in the main built in individual units and so installed that the ties pass automatically from one to the next. Any one or more may be either installed or operated without consideration of the rest.

There are two distinct systems followed in installing these machines, each of which has advantages peculiar to itself, the choice being governed by the conditions under which it must operate. These are installations in fixed locations, and portable installations in which the machine is mounted in a car which may be moved from place to place. Each system has strong advocates but apparently there is little difference in the ultimate economy. The stationary type has somewhat greater output, but this is offset in a great degree by the cheaper handling of ties to the portable type. Since there are more stationary than portable plants in operation at the present time, doubtless this type is deserving of the closer study.

Stationary Installations

For the complete four-unit type of trim saw, adzer, borer and brander, and with in and out tramcar tracks, skidways and conveyors, a building is required 66 ft. 6 in. long by 36 ft. 6 in. wide. The mill building is one story high, 14 ft. to the plate with gable roof. A shed-roofed lean-to 12 ft. x 16 ft. at one side provides accommodations for the toolroom equipment which includes the knife grinder, saw grinder, two work benches, emery-wheel stand, tool cabinet, countershafting and motor for driving the grinders and the usual set of mechanic's hand tools and vises.

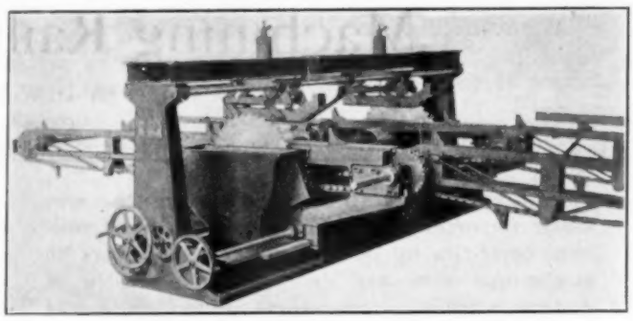


FIG. 2. TIE-SAWING OR TRIMMING MACHINE

The incoming tram track is 2 ft. higher than the outgoing one. This provides the desired elevation for unloading and reloading the trams in the mill and gives a down-grade pitch to the track for moving the empty tram cars around the mill by hand. The machine foundation is a raised platform of 4-in. thick wood plank carried on heavy timber stringers supported by concrete posts from the concrete floor of a pit 5 ft. deep. The shavings-exhaust pipes and waste-ends conveyor are placed within this pit. The tie machines, their countershafting and motive power are placed on the raised platform. On this platform at one side of the machine an operator's station is built up about 2 ft. high. Control levers governing the machine operation are extended to this point from which he can watch and command the entire action.

Trains of loaded tram cars en route to the treating cylinders are switched up the 1½ per cent up-grade ingoing mill track. At the mill the track starts on a 1½ per cent downward slope, passes through the mill on a return bend at the rear side and back to connect with the main line. Loaded trams are cut off the train and pushed on the down grade into the mill. When empty they are moved around the return bend to the delivery side. Here they are reloaded, shoved out of the mill, the bales applied and they are moved on down the track and again made up into trains and switched to the retorts.

Unloading the Ties

Ties enter the mill in tram cars that stop in front of the skidways. A tram-car dumping rig removes the load of ties from the car and deposits it on the skidways. This consists of an overhead winch, driven by power. The double capstans wind up chains securely anchored at their lower ends to heavy cast-iron abutments over which the ties are rolled by the tightening action of the chains. As the winch unwinds the chains lower and rest in slots in the floor, permitting the tram car to pass on.

The bales are removed from the tram cars just before the loads enter the front side of the mill. As the trams are unloaded they are moved around the circular track to the delivery end of the mill. Here they are reloaded and moved out to the front side of the mill where the bales are again applied. Wherever possible the mill should be located between the stacking yard and the treating cylinders so that all ties must pass it in their movement between these two points.

The ties are halted in their fall down the skidways by railroad rails suspended from overhead. Two men, one either side of the skids, place the ties face downward in the correct endwise position on the machine's in-feed conveyors. The passage of the ties from this point through the machines is automatic and the trimming, adzing, boring and branding and delivery to the out-feed conveyors are accomplished mechanically. From the out-feed conveyors the ties drop into the outgoing tram car and are properly laid in place by two laborers. A loading form that outlines the bale circle assists the men in finishing off the load so the bales will fit in place when the loaded tram car leaves the mill. Since ties bind against the form, this device is arranged to swing as the load moves out and thus not interfere with the movement of the car.

Ties pass through the machines face downward and all operations are performed from below. Provision is made so the regular run of ties, large and small, straight and crooked, pass through as they may come and are automatically machined regardless of their irregularity of size and form.

Description of Machines

The double trim saw (Fig. 2) cuts about ½ in. off each end of the ties. This removes the old hardened end wood, thus permitting better penetration of the chemical used for preservation, makes all ties of equal length, which makes for better and neater roadway, presents true surfaces for the brand and principally discloses the condition of the internal state of preservation.

The design comprises a heavy cast-iron base upon which are mounted housings that carry the saw arbors and feeding mechanism. The housings are gibbed to the base and are movable longitudinally upon it by means of large screws and a back-geared handwheel. Each carries an independently driven saw arbor. The feed consists of two endless chains driven through speed-reducing gearing from the main countershaft. Refuse removal is accomplished by a shavings-exhaust fan piped to the dust chutes beneath the saws, and by a block conveyor which removes the waste ends and delivers them where required. This conveyor is of the chain type and is placed below the base, receiving the waste from the hoppers outside the saws.

The tie-boring machine (Fig. 3) is usually employed in combination with the trim saw and adzer, but there are some cases, such as work on sawed ties, where boring alone may be deemed sufficient. The feed is by means of a set of hinged and counterweighted dogs which are reciprocated by a cam and lever movement through worm and spur gearing. On the backward stroke the dogs pass under the ties, rise behind them and carry them ahead on the forward stroke. This intermittent feed gives time for the boring operation to take place upon the tie which is between the clamps. Feeding and discharge conveyors of any reasonable length may be applied.

A centering and clamping device holds the ties while the bits are boring, and automatically locates the holes so that the plate will rest correctly in the center of the available timber. This device consists of a pair of cam-operated spring-hinged centering and clamping jaws carried by the overhead supports and operated in unison with the bit-spindle feed. The centering jaws are assisted in their clamping work by four sets of graduated hold-downs that prevent the tie from raising. Since the centering device operates on the exact center line of the rail, the boring is located in the center of the available timber.

The bit spindles are arranged in two groups of two, three or four spindles each with adjustment between the groups for gage, and between the spindles of each group for different widths of rail bases and tie-plate punching. A tie-boring templet having hardened bushings for guiding the tie-boring bits assures correct boring. Templets are made for each type of boring and are properly marked for identification.

The Automatic Adzing Machine

The automatic adzing machine (Fig. 4) produces perfect plane surfaces at the points where the rails or tie plates will rest. Its productive capacity is so great and its operation so simple that perfectly surfaced ties can be turned out at very small fraction of the cost of hand adzing. The heavy cast-iron bedplate carries two housings, one fixed and one adjustable thereon. Each of the housings carries an independent arbor with a shear-cutting, expansion adzing head, 11 in. in diameter and cutting up to 14 in. wide. The adzing heads are surrounded by refuse chutes arranged for connection to a shavings-exhaust system. Above each head is carried a weighted hold-down shoe having its fall regulated by an air cushion. The feed is by endless chains fitted with carrying dogs and driven by gears from the main shaft. A self-adjusting equalizing device which automatically raises or lowers one or both of the ways upon which the ties travel over the cutting heads so functions that the depth of cut is divided equally between the two ends regardless of bends in the tie, instead of the low end being cut much deeper than the other.

The operation of the brander is both automatic and hand-controlled. After the boring operation is completed the tie is released from the clamps and moves forward where it strikes a trip which operates supply valves and allows compressed air to enter the valve chests. The cylinder valves are operated by a cam connected with the feeding mechanism of the boring

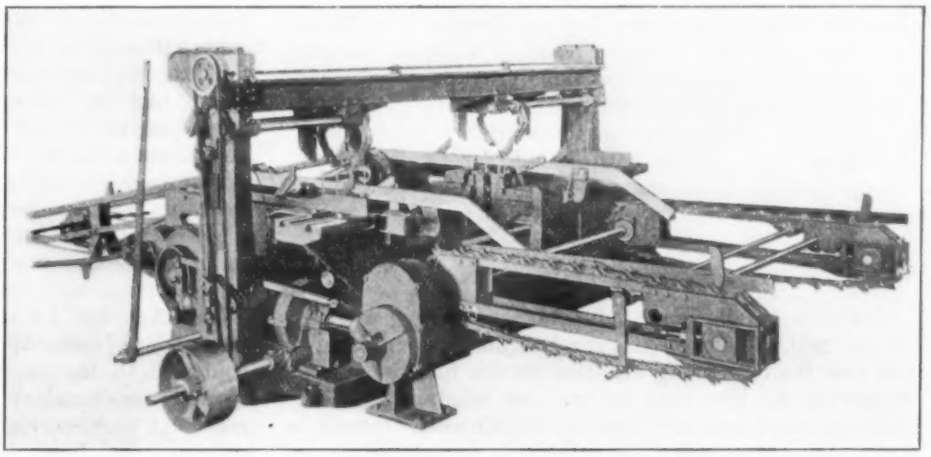


FIG. 3. AUTOMATIC TIE BORING MACHINE

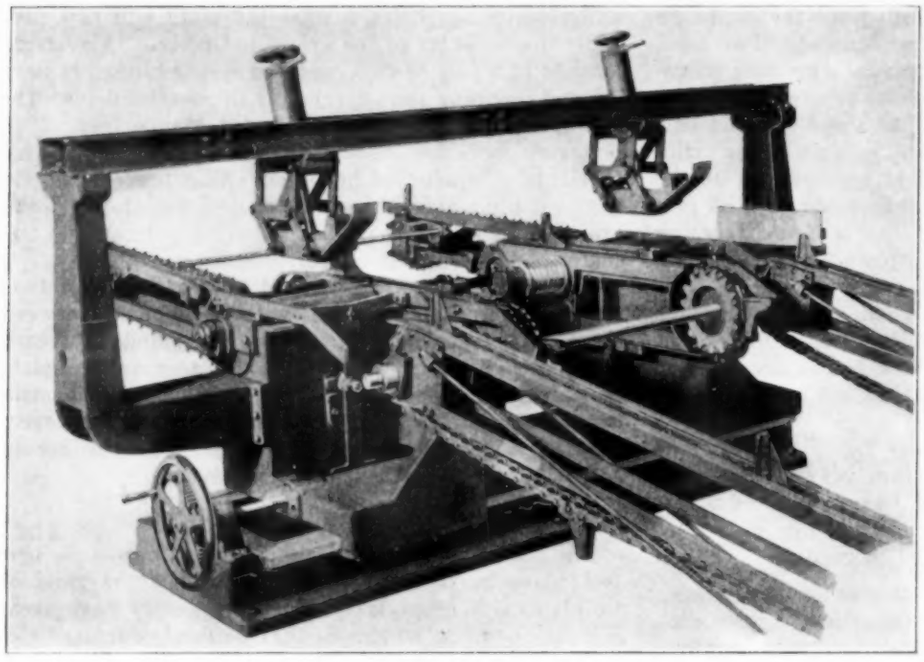


FIG. 4. AUTOMATIC TIE-ADZING MACHINE

machine and are timed to open when the tie arrives between the dies. The blows are struck on both ends simultaneously and the dies withdrawn. The feed then discharges the tie from the machine. As ties which have S-irons driven in their ends to keep them from splitting should not be subjected to the branding blow, a lever is provided by means of which the machine operator can cut off the air and cause the cylinders to miss the stroke when the ironed tie comes between them.

The Sawing Operation

In-feed conveyors deliver ties from the skidways to the machine proper. The trim saw is placed first in the train. Saws 30 to 36 in. in diameter are used. The adzing machine receives the ties from the trim saw. The boring-machine feed moves them at an accelerated speed to the bits. There they pause, are centered, clamped and bored, and passed on to the brander which is placed to the rear of the borer. Out-feed conveyors pick up the ties at this point and deliver them to trams. These conveyors are fitted with an accumulator which when thrown in causes ties to be retained by the conveyor while the outgoing trams are exchanged. This provides time for the operators to dispose of a loaded and place an empty tram in position without stopping the machine feed; thus constant production is maintained. A shavings-removal system is provided. The machines are built with shaving chutes at each adzing head and group of bits, with flanges for connecting the piping leading to a shaving-exhaust fan. A cyclone dust collector is used where shavings are delivered in the open.

Portable Installations

Portable installation is advantageous when plant conditions make it more economical to take the machine to the ties than to bring the ties to the machine. Also where the machine may be required only a part of the year in one plant and can be conveniently moved to another and thus be kept in practically continuous operation throughout the year. This is important as it materially reduces the machining cost per tie, because the fixed charges are spread over a greater volume of output.

Its daily output is less than that of a machine in a fixed location, but as one handling of the ties is eliminated its unit production cost varies little from that shown by the stationary engine. A compromise arrangement is often adopted which involves placing the portable machine in a fixed location in the yard and bringing the ties to it in trams. This gives practically the same output as a machine on a stationary foundation but with a smaller original investment.

The car which forms the basis of the portable outfit must be of steel underframe construction, 50 ft. long and of the greatest possible width, within standard clearance limits. While it may be a little less it works out best when at least 9½ ft. wide. Its load capacity should be not less than 80,000 lb. It is better to build the necessary superstructure on a flat car, arranging the openings as dictated by the machine layout, than to remodel a box car.

The power plant is usually a heavy tractor-type internal-combustion engine. When the trim saws are included in the equipment a six-cylinder engine developing 90 hp. is employed. When the saws are not included a four-cylinder engine of 62 hp. is sufficient. The main motor is usually furnished with a small auxiliary gasoline engine for starting. Gasoline is used for starting after which distillate or kerosene is used for running. Through a suitable transmission with lever control the engine drives directly to the tie machines or to the car axles giving a self-moving speed of about 100 ft. per minute for traveling about the tie yard.

Portable Plant Equipments

Portable plant equipments include the trimming, adzing, boring and branding sections, power plant, car-propelling device, tram-moving winch, shavings-exhaust system, knife grinder, work benches and an electric-lighting plant consisting of an independent direct-connected engine and generator with switchboard. While this is a good deal of equipment in a small space, it is a fact that there is room sufficient for the economical operation and maintenance of the entire outfit. To operate a tie-machining plant a crew of eight men is required, consisting of one foreman mechanic, his assistant, the machine operator and five laborers. Six to seven ties per minute are run and 2,500 to 3,000 ties per day are machined, or approximately 500,000 per year.

The total cost, including interest on the investment, maintenance, operation and all other items of expense incidental to the production of the finished cross-tie perfectly machined and properly prepared for chemical treatment and service, is so small in proportion to its real value as shown by the results obtained that railroads generally are now fast adopting this method.

Chart for Determining Safe Loads

By J. B. Conway

In general mechanical design it is necessary to predetermine just what will be the safe load that a piece of given dimensions will sustain or the size of a piece when the load is known. Those whose work necessitates frequent calculations of this nature usually have the necessary formulas and other information at hand; but in tool design and shop practice the proportioning of parts is customarily arrived at by the use of good judgment or factors governing the design that cannot be altered. In the latter instance the metal is proportioned for strength and rigidity with but very few, if any, preliminary calculations. On the other hand, if such information as is required was available in condensed form for ready reference, greater reference would be made to it. The accompanying chart is designed to facilitate the work of proportioning parts such as shafting of short lengths, after general machine and tool practice. A study of it will no doubt prove helpful to those having occasion to use data of this nature.

The formula, which is the basis of the chart, is $P = AS / f$, where A = area of the part in square inches; S the unit stress in pounds per square inch or ultimate strength; f = the factor of safety; and P = safe load in pounds. The formula is for calculating the dimensions of small parts when the stress is known, or vice versa, and pertains to parts whose length does not exceed ten times the smallest diameter or shortest side, if a square. For parts exceeding such dimensions, the usual formula for columns should be used.

As an example, let us assume that it is required to find the diameter of an axle with bearings on either end, supporting a load of 40,000 lb., to safely resist shearing. Since there are two bearings the stress on each will be 20,000 lb. Assuming that the path traveled by the wheels is irregular and that consequently the load varies it will be safe to use a factor of safety, for wrought-iron, of 6; the unit stress, or ultimate strength of the material will be taken as being 50,000 lb. Then $A = Pf/S$, or $A = 20{,}000 \times 6 \div 50{,}000 = 2.4$ square inches. The diameter will be the square-root of 2.4/0.7854 or 1.75 in., the diameter necessary to withstand a shear-load of 20,000 lb.

Referring to the chart we find two double scales upon which are plotted the values of A, S, P and f. To solve the above problem with the chart, first locate the load, 20,000 lb., and from this point lay a straight-edge or triangle across the chart connecting the factor of safety, 6, with the former value. The intermediate vertical line on the chart acts as a support for the result of this operation. At the intersection of this line with the edge of the triangle, pivot the triangle and swing it until one end rests on the value of S, or 50,000 lb., then

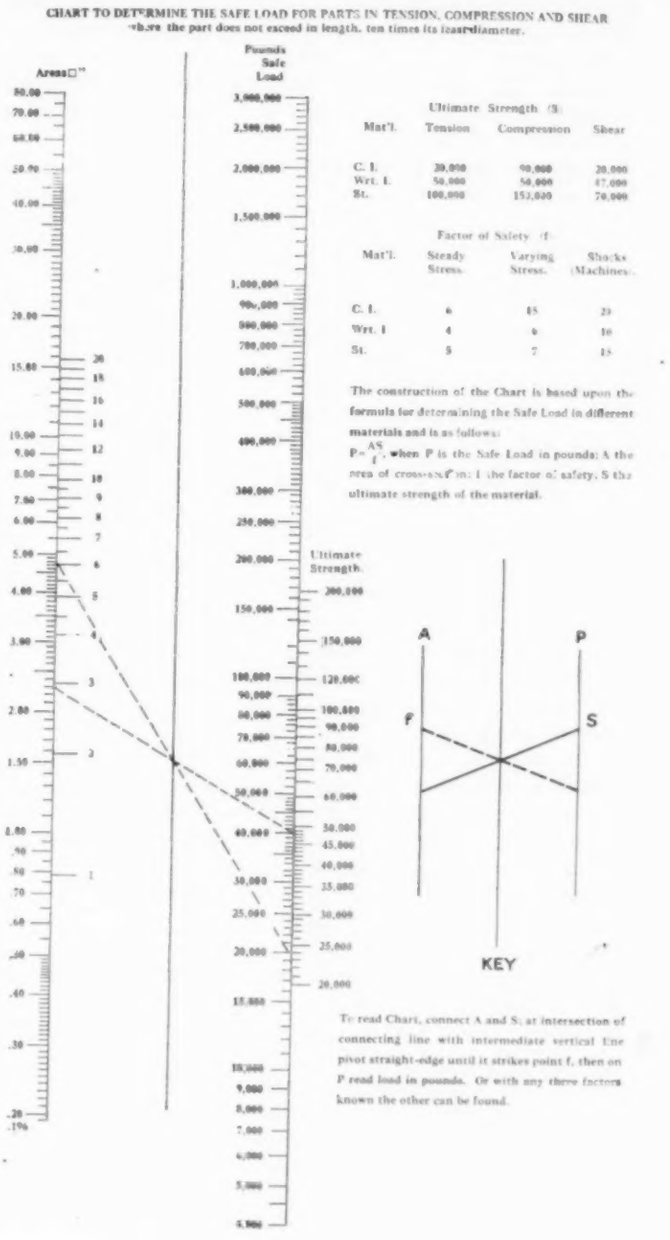


CHART TO DETERMINE THE SAFE LOAD FOR PARTS IN TENSION, COMPRESSION AND SHEAR
where the part does not exceed in length, ten times its least diameter.
Areas □"
Pounds Safe Load
Ultimate Strength (S)
Mat'l. Tension Compression Shear
C. I. 30,000 90,000 20,000
Wrt. I. 50,000 50,000 47,000
St. 100,000 153,000 70,000
Factor of Safety (f)
Mat'l. Steady Stress. Varying Stress. Shocks (Machines)
C. I. 6 15 23
Wrt. I 4 6 10
St. 5 7 15
The construction of the Chart is based upon the formula for determining the Safe Load in different materials and is as follows:
P = AS/f, when P is the Safe Load in pounds; A the area of cross-section; f the factor of safety, S the ultimate strength of the material.
Ultimate Strength
A
P
f
S
KEY
To read Chart, connect A and S, at intersection of connecting line with intermediate vertical line pivot straight-edge until it strikes point f, then on P read load in pounds. Or with any three factors known the other can be found.

on the opposite scale read the area in square inches, in this problem 2.4. The diameter is then calculated. Similarily, if the diameter were known and it was desired to ascertain the load that the axle would sustain, the operation would be to first determine the area, then connect the area, on the chart, with the unit stress, swing triangle to factor of safety and read 20,000 lb. as the load per bearing.

The table represents fair average ultimate strengths, although these values are of course subject to change when warranted. The factors of safety given are representative of good practice and afford a considerable range to choose from, as any values between those given can be used; this change rests largely with the good judgment and experience of the designer and his knowledge of the material he is working with.

It will be found interesting to give some study to the chart with the idea of acquainting one's self with the various stresses that parts of given dimensions will sustain, other factors varying. For instance, take the above example and vary *f*, the factor of safety. If 4 were used, the safe load supported would be 30,000 lb. Varying *S*, say to 30,000 the result is 3.1 square inches, or a diameter of 2 inches. Similar problems dealing with tension and compression are solved in the same manner, the values of *S* changing for the different methods of loading and those of *f* changing with the character of the load.

Problems similar to the following can be readily and quickly solved: What force will be required to punch a hole 1 in. diameter in a wrought-iron plate 0.375 in. thick? The area in square inches = 1 in. × 3.1416 = 1.1781 sq.in. Assuming 50,000 for *S*, locating this value on the chart, connect with area, swing triangle to 1 = *f*, and read 59,000 lb. (by calculation this result is 58,905). What load will a 1-in rod support, in tension, assuming 5 for *f*; and 90,000 as the value of *S* for steel? Area = 0.7854 sq. in.; connect area with load, swing to f = 5 and read 15,000 lb.

Plain vs. Grooved Winding Drums

BY JOHN S. WATTS

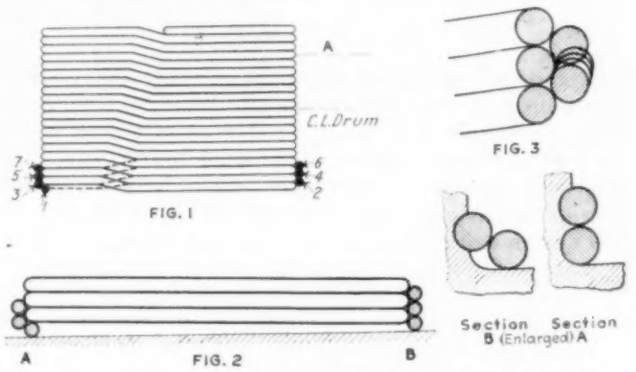
A clear understanding of the action of the rope being wound up on a drum when a number of layers of coils are to be carried, is very essential for the proper layout of the relative positions of the hoist and the head sheave. It may also tend to settle the much vexed question as to the relative superiority of the plain or grooved drum.

Studying the plain drum first, and referring to Fig. 1, it will be seen that the ropes are not laid spirally, but in parallel coils. It is necessary that the first coils that are left permanently on the drum, that is those which do not uncoil when in use, be laid as shown for better coiling of the second and succeeding layers as will appear further on in this article.

If it is not otherwise a detriment, the better way is to leave coils on the drum permanently up to the center line of the drum, the head sheave being in line with this center line. The remaining coils will, of necessity, be close coiled and parallel to the first coils as shown in Fig. 1. If the drum has not sufficient capacity to allow this arrangement it will be necessary to place the head sheave in line with the line marked *A* which will be a line through the center of the last coil which is left on the drum permanently because if the head sheave is set on the center line, and the rope commences to coil on the drum at the line *A*, that part of the coils between line *A* and the center line of the drum will not coil closely.

The second layer of coils will follow the path indicated by the dotted lines, and can be traced by following the lines from circle 1 to 2, to 3, etc. It will be clear that the second layer is guided into close coils by the grooves formed by the ropes in the first layer of coils which prevent the second layer from traveling along the drum to the center line of the head sheaves, except as forced to by the preceeding coils pushing each succeeding coil over into the next groove.

This action compelling the rope to coil closely will continue indefinitely so long as the rope is under strain and kept taut. If the rope is allowed to become slack, the tendency will be for it to slide over to get in line with the head sheave and cannot be prevented by any method of coiling.



FIGS. 1 TO 3. WINDING CONDITIONS ON PLAIN AND GROOVED DRUMS

Fig. 1—Rope wound on plain drum. Fig. 2—Rope wound on grooved drum. Fig. 3—Second layer of rope on grooved drum being crowded over into position.

Considering now a grooved drum, the groove must of necessity be a helical one, and it is permissible to commence coiling at the side of the drum with the head sheave in line with the center line of the drum, as the grooves will counteract the tendency of the rope to coil loosely until it gets in line with the head sheave.

Coming now to the second layer of coils, the last coil of the first layer, see Fig. 2, leaves a space whose width narrows from the diameter of the rope to zero in the circumference of the drum, forming a long wedge-shaped space. Into this space the first coil of the second layer is wedged, gradually climbing out of it as the space narrows, as indicated in the sectional views in Fig. 2 until it gets on top of the first layer.

This jamming of the rope into the tapering space throws a severe bending strain on the rope when the load is being lowered, due to the pull necessary to get it out so as to be free to uncoil. The trouble can be averted on the first coil by fitting a filling-in piece on which the first coil of the second layer will ride without getting wedged in between the last coil of the first layer and side flange of the drum. It is clearly impossible, however, to do this for any of the succeeding layers.

In this respect the method of coiling on a plain drum, as shown in Fig. 1, is much superior, as the wedging atcion is practically eliminated.

With the grooved drum, if the first layer is laid in a right-hand helix the second layer will be a left-hand helix, or vice versa. The rope in the second layer will travel in the grooves made by the first layer until pushed over into the next groove by the preceeding coil, as

indicated in Fig. 3, which shows the rope rising out of one groove until it is on the very top of the rope in the first layer. From this position the rope drops suddenly into the next groove with a shock that cannot but be a severe strain on the rope.

This crossing of the coils takes place in the plain drum also, but a little consideration will show that if the rope is laid as shown in Fig. 1 the drop is much less serious.

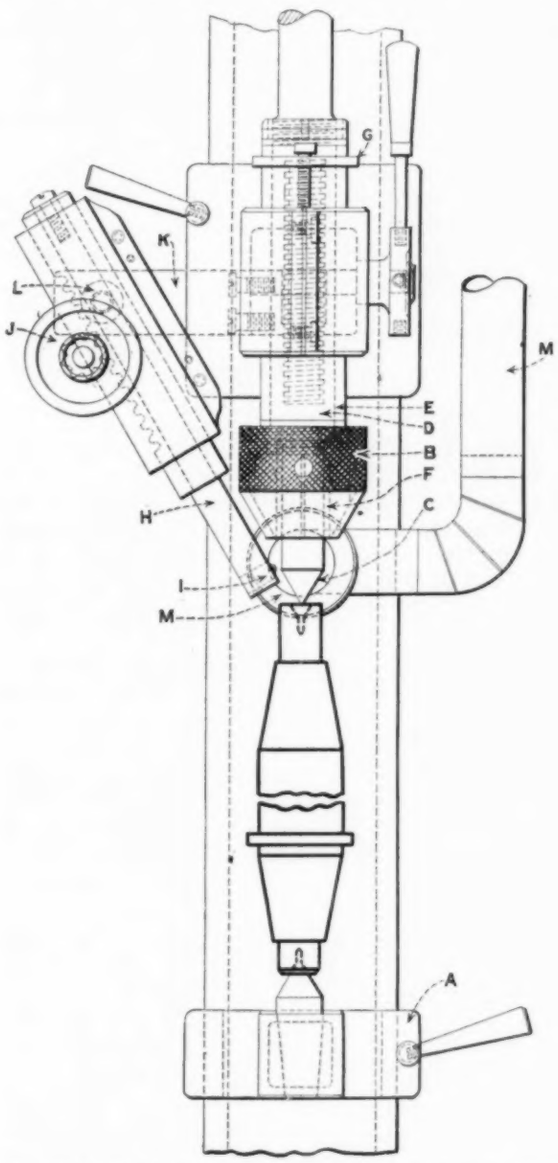
In my opinion, then, the plain drum is much to be preferred if the coiling is properly started.

Lapping Center Holes in Hardened Work

BY A. L. EDDY

I recently designed equipment for a small sensitive drilling machine for lapping center holes in hardened work and from which we are obtaining excellent results.

The type of machine chosen for this operation was constructed with ways running the entire length of the standard to which bracket *A*, holding a center that could be adjusted for various lengths of work, was attached.



ATTACHMENTS TO DRILLING MACHINE FOR LAPPING CENTER HOLES

Notice that chuck *B*, for holding lap *C*, is a part of spindle *D*. My object in this manner of construction was to obtain the best results, bringing the lap closer to the spindle bearing *E*, causing less vibration, and also to economize on space and weight.

The chuck *B* is equipped with the brass split bushing *F*, which will prevent the lap wearing the chuck jaws, also acting as a support to the lap.

For the purpose of holding the lap *C* steady when truing it off, the stop *G* was constructed by making a clamp that was fastened to spindle bearing *E*, holding a knurled head screw which rests on the spindle bracket when truing off the lap.

The truing device was constructed by making the spindle *H* to hold the diamond nib *I* and inserting the spindle into a quill which is operated with the pinion and handwheel *J*, the housing for the rack being made adjustable to take up any wear.

This fixture was fastened to the spindle bracket with the bracket *K* and swivels on the bearing *L* which gives a close adjustment for truing the angle of lap *C*.

To prevent the abrasive dust from penetrating the bearings and for sanitary reasons, the machine was equipped with the suction pipe *M*, leading to an exhaust fan.

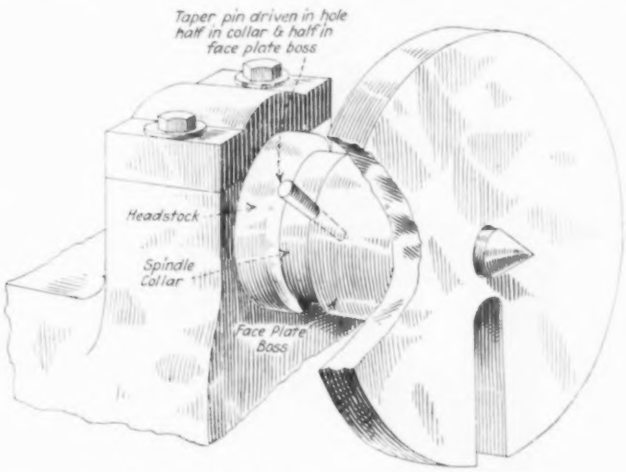
Making several tests of various grades of laps, the best results were obtained from using a lap made from alundum, grain 80, grade 0, which gave a hard smooth surface.

Rotating the lap at a speed of 1,800 r.p.m. gave us the desired results.

Securing the Faceplate When Running the Lathe Backward

BY H. H. PARKER

When winding coils and doing similar work it is desirable to run the lathe backward. If heavy wire is being wound there is much trouble caused by the face-



HOLDING FACEPLATE WITH A TAPER PIN

plate or driver becoming loosened and unscrewing. A good way to overcome this trouble is to drill a small hole through edge of the lathe spindle collar and the boss of the faceplate, the latter being first tightly screwed up. The hole is half in the collar and half in faceplate boss. It is taper reamed and a taper pin is then driven in lightly, leaving enough projecting to

allow of its removal with a pair of pliers. With the pin in place it will be impossible for the faceplate to unscrew. This plan is also of assistance in screw cutting where the lathe is run backward.

A Gear Problem

By H. Liddiatt
Wolverhampton, England

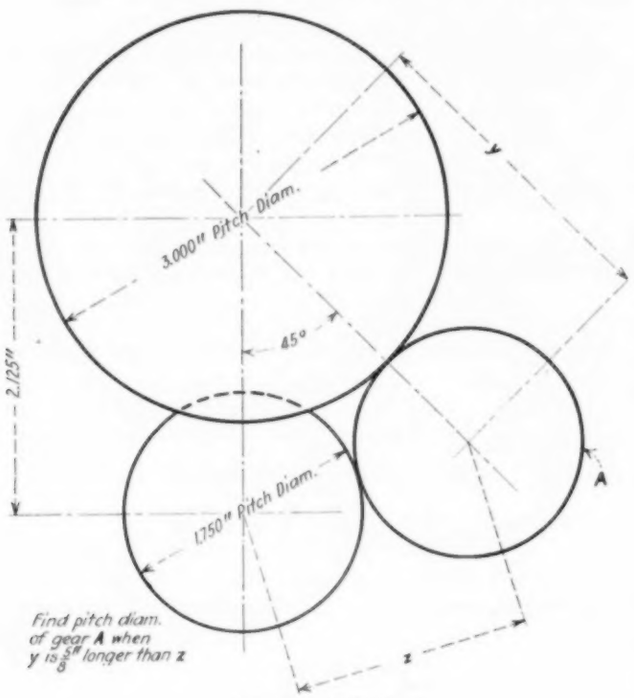
The problem shown by the sketch occurred in the design of a drilling head and was solved by using the well known cosine formula:

$$Z^2 = (2\tfrac{1}{8}^2 + Y^2) - 2 \times 2\tfrac{1}{8} \times Y \times \cos 45°$$

Y is given $\frac{5}{8}$ in. longer than Z.

Call $Y = Z + \frac{5}{8}$, and use this in the equation

$$Z^2 = (4.515625 + Z^2 + 1\tfrac{1}{4}Z + \tfrac{5}{16}) - (4\tfrac{1}{4} \times (Z + \tfrac{5}{8}) \times \cos 45°)$$



GEAR LAYOUT

$$Z^2 = (4.90625 + Z^2 + 1\tfrac{1}{4}Z) - (4\tfrac{1}{4}Z + 2\tfrac{31}{32} \times \cos 45°)$$

Transposing terms

$$Z^2 + (4\tfrac{1}{4}Z + 2\tfrac{31}{32} \times \cos 45°) = Z^2 + 4.90625 + 1\tfrac{1}{4}Z$$

Then

$$4\tfrac{1}{4}Z + 2\tfrac{31}{32} \times \cos 45° = 1\tfrac{1}{4}Z + 4.90625$$

$$4\tfrac{1}{4}Z + 2\tfrac{31}{32} = \frac{1\tfrac{1}{4}Z + 4.90625}{\cos 45}$$

$$4\tfrac{1}{4}Z + 2\tfrac{31}{32} = 1.7677Z + 6.9385$$

$$2.4823Z = 4.28225$$

$$Z = 4.28225 \div 2.4823$$

$$= 1.725 \text{ in.}$$

$$Y = 1.725 \text{ in.} + 0.625 \text{ in.}$$

$$= 2.350 \text{ in.}$$

$$= 1.700 \text{ in.}$$

Pitch diameter required $= (1.725 - 0.875) \times 2$

$$= 1.700 \text{ in.}$$

Proof:

$$Z = \sqrt{(2.125^2 + 2.350^2) - (2 \times 2.125 \times 2.350 \times \cos 45°)}$$

$$= \sqrt{2.975625}$$

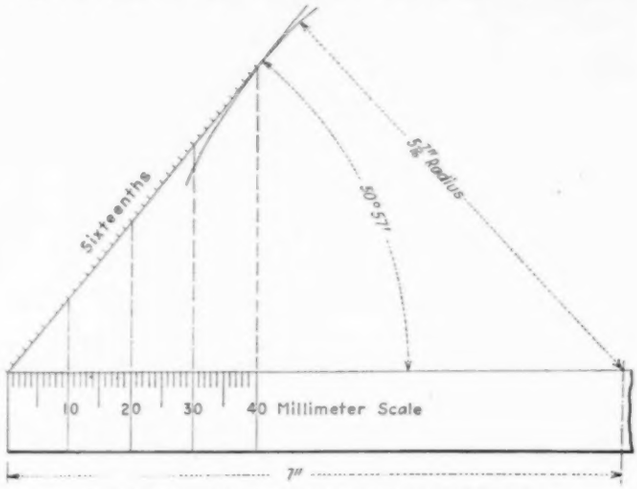
$$= 1.725 \text{ in.}$$

Graduating a Scale to Millimeters

By Chester E. Josselyn

A demand for a scale graduated in millimeters was met by the construction of the one here illustrated.

It was found that a scale of sixteenths placed on an angle of practically 51 deg. serves for the purpose, each



GRADUATING A SCALE TO MILLIMETERS

division when projected to the base line representing one millimeter.

To obtain the angle with greater accuracy than by using a protractor, lay off 7 in. on the base line and from one end describe an arc of $5\frac{7}{8}$-in. radius. From the opposite end of the 7-in. line draw a line tangent to the arc.

Piston Clearances for Internal Combustion

By George M. Richards

In reference to C. Strom's article on "Piston Clearance for Internal Combustion Engines," on page 615 of *American Machinist*, it would be of interest to know if Mr. Strom has ever tried Charles T. Porter's method of first turning the piston the exact diameter of the cylinder and then turning the upper half of the circumference about $\frac{1}{32}$ in. smaller by throwing it out of center.

Years ago I had the same trouble as Mr. Strom and tried to overcome it the same way, at the same time knowing that I was thereby inviting other troubles and spending a lot of time in doing so. Mentioning the matter to Mr. Porter one day he suggested the above treatment and since then I have never found it necessary to remove a piston on account of sticking, and also found that it prolonged the life of the cylinder. As the lower half of the piston is then of the same radius as the cylinder and makes a tight joint against the wall, it is quite evident that if the ends of the piston rings are at the bottom, slightly staggered and dowel pinned, the piston will be tight and remain so.

I have used this method on vertical as well as horizontal gas and oil engines with equal success, using the concentric side of piston on the thrust side. I have also bored the flywheel hub to the exact diameter of the shaft and then bored the keyway-half out of center, which facilitated moving the wheel on the shaft and at the same time brought the lower half in complete contact with the shaft.

Executive Board of American Engineering Council Organized

HERBERT HOOVER, president of the Federated American Engineering Societies, presided at the executive board meeting of the American Engineering Council of that organization, held in New York City on Friday, Dec. 17. Every member of the council was present, with the exception of A. M. Greene, and two new members of the board were elected: W. B. Powell of the Buffalo Engineering Society, representing district 1 (New York and the New England states), and Gardner S. Williams, of Grand Rapids Engineering Society, representing district 2 (Michigan, Wisconsin and Minnesota).

Standing Committees Appointed

The president appointed the following standing committees: Procedure, Calvert Townley, chairman; Herbert Hoover, ex officio; W. E. Rolfe, D. S. Kimball, J. Parke Channing, L. W. Wallace and L. P. Alford. Constitution and By-laws, W. B. Powell, chairman; C. F. Scott and D. S. Kimball. Publicity and Publications, L. P. Alford, chairman; H. W. Buck and H. E. Howe. Membership and Representation, J. F. Oberlin, chairman; L. W. Wallace and A. S. Dwight. Finance, William McClellan, chairman; E. Ludlow, C. Townley and L. W. Wallace, ex officio. Public Affairs, J. Parke Channing, chairman; Fred J. Miller and L. B. Stillwell.

In discussing the program of the council immediately under consideration Mr. Hoover stated that he had called engineers together in various cities he had visited lately and that he found that the general desire of engineers everywhere was to join in the F. A. E. S. movement, but that the general trend was for territorial organization as distinguished from national organization. One of the stumbling blocks in the way of these territorial organizations joining the national organizations was the question of dues. Another complexity was that individuals hold memberships in more than one society. For example, the Western Society of Engineers has about four thousand members, of which three thousand are already members of national societies which have affiliated with the F. A. E. S. Mr. Hoover also stated that there had been some opposition to the Federation based on the constitution, but that the question of territorial organization was the most important, and he suggested that a committee should be appointed to canvass and help the situation. This question was discussed and referred to a special committee, which will include the six district delegates.

As a step forward in co-ordinating various inter-society activities already established the necessary action was taken to make it possible for certain of the activities of the Engineering Council to be taken over by the new organization. As soon as the United Engineering Societies have passed officially upon the proposed action of the Engineering Council to transfer and continue the work of the Engineering Council's committees which have not yet completed their work the president will appoint the necessary committees of American Engineering Council to take over this work. At the meeting of the Engineering Council held in Washington there was harmony among all the member societies in the Engineering Council to this end. In this connection action was taken to amend section 9, paragraph 6 of the by-laws so that members of committees can be selected from societies of the American Engineering Council other than those at present members of the Federation. Civil engineers and engineers in other bodies not at present affiliated with the Federated American Engineering Societies can, because of this action, co-operate in the committee work.

The four so-called founder societies in addition have been associated in a common employment service, and the American Engineering Council has offered to take over this service as a part of its function.

The American Engineering Council voted to act independently as a unit and not to affiliate with the Chamber of Commerce. It was the thought of the meeting that the council could make its best contribution to the public by acting independently.

The council authorized the appropriation of $1,000 as an initial fund to carry on publicity work and the committee on publicity and publications was given authority to set up a board of engineering editors.

It was voted that full expenses of members of the executive board for attendance at meetings would be paid.

A special committee reported on candidates for permanent executive secretary of the organization, but no final action was taken at the meeting.

A general feeling was expressed that the meetings of the board should be held at different centers and the place of the next meeting, which will be held on Feb. 11, was left to the discretion of the president.

Members and Officers of Executive Board

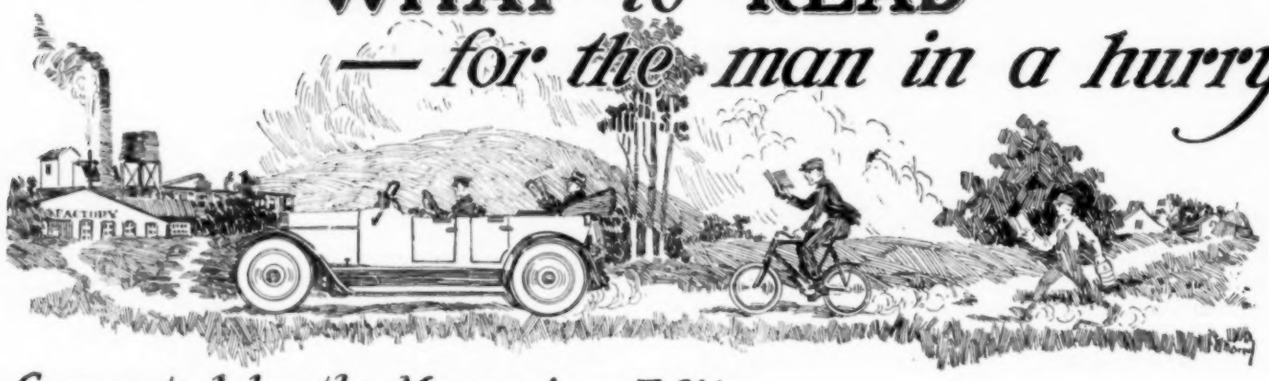
The following members of the executive board and officers were present:

Officers: President, Herbert Hoover, American Institute Mining and Metallurgical Engineers. Vice-presidents, Calvert Townley, American Institute Electrical Engineers; William E. Rolfe, Associate Engineering Societies of St. Louis; Dexter S. Kimball, American Society of Mechanical Engineers; J. Parke Channing, American Institute Mining and Metallurgical Engineers. Treasurer, L. W. Wallace, Society of Industrial Engineers.

Members of executive board (national societies): E. Ludlow, A. S. Dwight, P. N. Moore, all of the A. I. of M. and M. E.; L. P. Alford, F. J. Miller, E. S. Carman, all of the A. S. M. E.; H. W. Buck, William McClellan, C. F. Scott, L. B. Stillwell, all of the A. I. E. E.; H. E. Howe, A. I. C. E.; M. L. Cooke, Taylor Society.

Members of executive board (local societies): W. B. Powell, District No. 1 (New York and New England States); Gardner S. Williams, Engineering Society and Detroit Engineering Societies, District No. 2 (Michigan, Wisconsin, Minnesota); J. F. Oberlin, Cleveland Engineering Society, District No. 3 (Ohio, Indiana, Illinois); W. W. Varney, Baltimore Engineers Club, District No. 4 (New Jersey, Pennsylvania, Delaware, Maryland and District of Columbia); O. H. Koch, Technical Club of Dallas, District No. 5 (Virginia, West Virginia, North and South Carolina, Alabama, Tennessee, Kentucky, Mississippi, Louisiana, Texas); L. B. Smith, District No. 6 (North and South Dakota, Nebraska, Kansas City, Oklahoma, Arkansas, Missouri, Iowa).

WHAT to READ
—for the man in a hurry



Suggested by the Managing Editor

A RAILROAD article opens this issue, the last of 1920. As we write "railroad" and "1920" we are reminded at once of the important events of the past year concerning our greatest means of transportation. From the experiment of government control, which must have convinced even its strongest adherents of its impracticability, the railroads have been returned to private enterprise and permission has been granted them to charge rates commensurate with their investments. The owners have entered well into the processes of repairing rolling stock and roadbed and of returning cars to their rightful roads; of introducing labor efficiency into their shops; of reducing standing time and under-loading of cars; and of educating the users of cars concerning the waste due to idle cars and cars not loaded to capacity. The chief duty of railroad shops is the repair of their equipment and if the roads wish to make conclusive the evidence of the advantages of present control they must not overlook the necessity of installing thoroughly modern equipment and instituting time, labor and material saving devices. With this introduction to a subject that we feel to be of real importance, we call attention to a number of railroad articles in this issue: "Production and Salvage of Locomotive Piston Rings," the opening article, by Western Editor Hunter; "Tests of Cast Iron for Locomotive Cylinder Parts," page 1221, from a technologic paper of the Bureau of Standards; "Slotting Machine and Planer Toolholders for Railroad Shop Use," page 1231, by Frank A. Stanley; "Frame Welding Apparatus in Railroad Shops," page 1232, by the same author; and "Machining Railroad Cross-Ties," page 1237, by D. W. Edwards. The titles indicate the contents and further comment seems unnecessary.

What to read was not a difficult matter to decide two hundred years ago when books were few and magazines unheard of. It is far different now when so much reading matter is offered to pass the time pleasantly or profitably as the reader chooses. We are doing our utmost to make the "American Machinist" not only profitable but indispensable as a clearing house of ideas and news of the machinery world. This page is the editors' advertisement of their section of the paper. It gives the high spots

The second installment of Colvin's "Building Motors on the Pacific Coast" begins on page 1215. It takes up the machining of crankcases for aircraft and marine types of motors.

Earle Buckingham's paper "Side Cutting of Thread Milling Hobs" is concluded, page 1222, by the section devoted to the hobbing of internally threaded parts. The first part, dealing with the hobbing of screws, was published last week.

On page 1225 begins the sixth and last of O. A. Kenyon's articles on brass making. It tells of the characteristics of brass and the laboratory and research methods used to determine them.

The difficulties in machining large water turbines so impressed our chief field editor on his coast-to-coast trip that he brought back photographs of some of the set-ups he saw in a San Francisco shop. He has combined reproductions of the photographs with a short description to make-up his story "Machining Large Water Turbines," which begins on page 1234.

Pages 1241 to 1244 inclusive are devoted to letters from practical men. A chart for determining safe loads is offered by J. B. Conway. John S. Watts compares plain with grooved winding drums. A. L. Eddy passes along his design of equipment for lapping center holes in hardened work. And an English correspondent, H. Liddiatt, solves a gear problem that he was up against while designing a drilling head.

A recent event that concerns machinery builders was the introduction in the Senate of Bill No. S 4675, "a bill to fix the metric system of weights and measures as the single standard for weights and measures." The *American Machinist* has, during the past year, given an abundance of reasons why the use of the metric system should not be compulsory and in this number, page 1248, we print the bill itself in full, knowing that its own provisions constitute a very strong argument against its passage. There seems to be no likelihood that the bill will be passed by the present Congress.

On page 1245 is our account of the meeting, on the 17th of this month, of the Executive Board of the Federated American Engineering Societies. Following as it does so quickly after the first meeting of American Engineering Council and including in its action the naming of committees and the formation of several definite lines for procedure, this meeting indicates that the Federation, in existence less than a year, is already on the way to hoped for results.

EDITORIALS

Ring Out the Old!

THE sound of the bells that ring out the old year will be sweet to many of us. 1920 will probably be a much pleasanter year to look back upon than it has been to live through, particularly the latter part of it. No matter how necessary the pangs of deflation, they have not been enjoyable. Those of us who have escaped them are few indeed.

On the first day of January, 1921, most of us can start in with a clean slate and go after new business with a will. If we may be pardoned for touching on a sore point, the loss of some of the business that has been wiped out by the depression of the last few months is not without its compensations. As one machine-tool builder put it recently: "It is better to have the goods and no money than to have neither one." The fellow with stock on his shelves or in his warehouse is going to profit when orders begin to come in. And that time is at hand. We know of more than one manufacturer who is booking real, honest-to-goodness orders for expensive machines and a good friend of ours has just told us that he is two weeks behind on one model.

Compared to the boom time we have been through these facts seem insignificant but when considered as harbingers of the revival of business they loom large. They should stimulate salesmen and managers to redouble their efforts in the buyers' market that now exists. Of course it is hard work to get orders in such a market, but hard work is good for everybody and the sales department has had little to do for a long time.

And now a word to the man who needs equipment. The buyers' market is his opportunity, but like other opportunities it will not sit around indefinitely and wait for him to grasp it. Just now he can get immediate deliveries on almost anything, but if he lets other buyers get their orders in ahead of his, he will have to wait his turn for delivery and may lose precious time in the manufacture of his own product. Most of us are thoroughly sold on preparedness for war, but are we fully awake to the need for equal preparedness for business competition?

The trend of affairs has its message for the production department as well. Capable managers have taken advantage of the lull to clean house and to take care of deferred or hastily made repairs. They worked wonders in getting out war material but they will have just as hard a task to face in 1921, in putting their production on a cost basis that will enable their salesmen to get the business. Money is most distinctly an object and will be for some time to come.

We of the *American Machinist* realize our responsibilities in the economic struggle that is just beginning and shall endeavor to do our part in helping American industry to hold its own and reach out for new markets. During 1921 we shall have frequent letters from our representatives in London and Berlin, and occasional ones from other parts of the world. They will tell of the technical and commercial developments in our field and will be valuable to the American manufacturers who face foreign competition at home and abroad.

We shall continue to devote considerable attention to the automotive industry and the railroad shops will receive their share of space. The material in preparation for the designers and engineers has unusual merit and will appeal both to the expert and to the beginner. Management articles will be strong and will appear frequently. Practical shop methods and "kinks" will be given the same prominence as before.

Our unique new equipment service will be continued for the benefit of the buyer, the seller and the user. We shall maintain its high standard and seek to amplify its scope.

In other words, the *American Machinist* for 1921 will be as well balanced as we can make it. The man in the office or drafting room and the responsible man on the job will find its columns filled with technical information, industrial and commercial news and forward-looking editorial comment of particular interest to himself. All in all volumes 54 and 55 will be efficient and indispensable tools for men in all ranks of industry and we commend them to your use.

Preventing Contract Cancellations in the State of New York

THE recent New York Supreme Court decision upholding the validity of the arbitration clause of the Walton Law will be a welcome one to contract cancellation victims. The clause in question says: "A provision in a written contract to settle by arbitration a controversy thereafter arising between the parties to the contract————shall be valid, enforcible and irrevocable, save upon such grounds as exist at law or in equity for the revocation of any contract."

The case which resulted in the decision mentioned was one brought by a far Eastern company against a New York company. The Eastern company had a contract for the sale of goods in which appeared this clause: "Any differences arising between the parties to this contract do not invalidate same, but shall be settled by arbitration at New York, unless otherwise specified herein, and decision by such arbitration shall be final and binding on both parties, each shipment to be considered separately." A shipment was made as agreed but the goods were refused by the New York company on the ground that they were of inferior quality. The purchaser declined to arbitrate. The seller then asked the Supreme Court to direct the purchaser to arbitrate under the provisions of the Walton Law. After hearing the evidence the court so directed.

The Walton Law was sponsored by the arbitration committee of the Chamber of Commerce of the State of New York in an attempt to mitigate the cancellation evil. There are certain features of the law that have not yet been passed upon by the courts but the clause concerning

the validity of arbitration agreements has at least been taken care of.

Chairman Bernheimer of the arbitration committee recommends that an arbitration clause to fit the particular case be included in every contract and that the clause be carefully drawn, with legal advice. Such a clause may not be an impregnable safeguard but it will certainly protect the seller or manufacturer in many instances. The provisions of the law are worth investigating.

Compulsory Metrics?

THERE seems to be, at this writing, little danger that Congress will pass the bill providing for compulsory use of the metric system of weights and measures, introduced in the Senate during the present session by Senator Frelinghuysen, of New Jersey.

The bill, as read, would compel the use of the metric system, and no other, from and after ten years from the date of its passage and approval with certain exceptions, of which the chief is apparently intended to be goods for export.

Furthermore, from and after *four* years from the date of passage and approval it would prohibit the manufacture, construction for personal use, purchase for use and conversion to use, of any weight or measure, or weighing or measuring device designed, constructed, marked or graduated to determine, indicate, or deliver weights or measures in any system other than the metric, in the transactions of selling goods, wares, or merchandise except for export, charging or collecting for the carriage or transportation of them, or collecting from or paying to another person for work or labors expended except those expended upon export goods.

Furthermore, from and after *two* years from the date of passage and approval it would prohibit the manufacture or packing, offering for sale or selling, of any goods, wares or merchandise in package form which are required by law to be marked in terms of weight or measure, unless they were marked in or according to weights or measures of the metric system, except in the case of goods for export.

The Frelinghuysen bill, if passed, would almost immediately involve us in a serious situation as regards our standards. Such legislation is not needed, is not wanted and must not come about.

The Metric System Bill Introduced in the Senate

A BILL providing for the compulsory use of the metric system of weights and measures after ten years from passage, has been introduced in the Senate by Senator Frelinghuysen, of New Jersey. Senator Frelinghuysen stated that he has no intention of pushing the bill and that he introduced it simply as a personal accommodation to one of his constituents. It is understood that the constituent is the representative in Washington of the "World Trade Club," of San Francisco. While Senator Frelinghuysen authorized no statement as to his position on the bill, a person in his confidence expressed the opinion that he is opposed to it.

It may be stated most positively that there is no chance to secure this legislation at this session of Congress. The bill will die with the Congress on March 4.

Representative Vestal, of Indiana, the chairman of the House Committee on Coinage, Weights and Measures, states very positively that there is no time at this short session to embark upon this type of legislation. Repeated efforts have been made to secure a promise from him to take some interest in this question. He does not intend to introduce a metric bill himself and is of the opinion that his committee would be very much averse to the giving of any consideration to such a measure at this time.

The bill has been read twice and referred to the Committee on Standards, Weights and Measures. The full text is as follows:

Bill No. S.4675

A BILL

To fix the metric system of weights and measures as the single standard for weights and measures.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That from and after ten years from the date of passage and approval of this act the weights and measures of the metric system shall be the single standard of weights and measures in the United States of America for the uses set out herein.

Sec. 2. That the fundamental standards of the metric system are the meter and the kilogram. The meter is the length at the temperature of 0 degree centigrade of the international prototype meter bar of platinum-iridum defined and adopted by the General Conference of Weights and Measures held at Paris in 1889, which bar is now deposited in the International Bureau of Weights and Measures at Sevres, France. The kilogram is the mass of the international prototype kilogram weight of platinum-iridium, which was similarly adopted and deposited.

Sec. 3. That the national prototypes of the fundamental standards of the metric system shall be the copies of these standards known as meter numbered twenty-seven and kilogram numbered twenty, allotted to the United States by the General Conference of Weights and Measures held at Paris in 1889. These are now deposited in the vault of the Bureau of Standards of the Department of Commerce, and are those which are now used and employed in deriving the values of all weights and measures used in the United States. These national representations are hereby adopted as the primary standards of weights and measures for the United States of America, and from these all other weights and measures shall be derived and ascertained.

Sec. 4. That from and after ten years from the date of passage and approval of this act no person shall do or offer or attempt to do any of the following acts, by weights and measures, in or according to any other system than the metric system of weights and measures; namely:

(1) Sell any goods, wares, or merchandise except for export as provided in section 12;

(2) Charge or collect for the carriage or transportation of any goods, wares, or merchandise; or

(3) Charge or collect from or pay or reimburse any other person for work or labor which has been or is to be performed or done, except that when in accordance with the provisions of section 12, weights or measures other than those of the metric system are used or employed in the arts, manufacture, or industry the wages of employees engaged in producing commodities in such weights or measures and paid by weight or measure of commodity produced may be computed and paid in terms of such weights or measures.

Sec. 5. That from and after four years from the date of passage and approval of this act no person shall manufacture or make for himself for use, or purchase for use, or convert to use, in any of the transactions detailed in section 4, any weight or measure or weighing or measuring device designed, constructed, marked, or graduated to determine, indicate, or deliver weights or measures in any other system than the metric system of weights and measures.

Sec. 6. That from and after ten years from the date of passage and approval of this act no person shall use or attempt to use in any of the transactions detailed in section 4 any weight or measure or weighing or measuring device, designed, constructed, marked, or graduated in any other system than the metric system of weights and measures.

Sec. 7. That from and after two years from the date of passage and approval of this act no person shall manufacture or pack, offer for sale, or sell any goods, wares, or merchandise in package form which are required by law to be marked in terms of weight or measure unless they be marked in or according to weights or measures of the metric system except the goods, wares, or merchandise on hand, and except for export as provided in section 12. Prior to ten years from the date of passage and approval of this act there may also be marked upon such packages the equivalent of the metric weight or measure in terms of weights or measures now in customary use. From and after ten years from the date of passage and approval of this act the marking in terms of weights and measures now in customary use is hereby prohibited, except for export as provided in section 12.

Sec. 8. That not later than ten years from the date of passage and approval of this act, all postage, excises, duties, and customs charged or collected by weights or measures by the government of the United States shall be charged or collected in or according to the metric system of weights and measures.

Sec. 9. That rules and regulations for the enforcement of this act, not inconsistent with the provisions hereof, shall be made and promulgated by the Secretary of Commerce.

Sec. 10. That all equivalents between the units of the metric system and the system now in customary use shall be calculated from the fundamental relations, one meter equals thirty-nine and thirty-seven one-hundredths inches, and one kilogram equals two and two hundred and four thousand six hundred and twenty-two one-millionths pound avoirdupois. Tables based upon these relations, showing the equivalents between the weights and measures of the metric system and those now in customary use, shall be prepared and promulgated by the Secretary of Commerce. The Secretary of Commerce shall also take such steps as he may deem expedient for giving publicity to the dates of transition specified herein and for facilitating the transition to the metric system.

Sec. 11. That all acts or parts of acts inconsistent herewith are hereby repealed, but only in so far as they are inconsistent herewith; otherwise they shall remain and continue in full force and effect. Whenever in any act, or rules and regulations, or tariff or schedule made, ratified, approved, or revised by the government of the United States of America, weights or measures of the system now in customary use are employed or referred to and to comply with the provisions of this act weights and measures of the metric system should be employed, then such references in such act, rules and regulations, tariff or schedule shall be understood and construed as references to equivalent weights or measures of the metric system ascertained in accordance with the fundamental relations set out in section 8 thereof.

Sec. 12. That nothing in this act shall be understood or construed as applying to—

(1) Any contract made before the date at which the provisions of this act take effect;

(2) The construction or use in the arts, manufacture, or industry, of any specification or drawing, tool, machine, or other appliance or implement designed, constructed, or graduated in any desired system;

(3) Goods, wares, or merchandise intended for sale in any foreign country, but if such goods, wares, or merchandise are eventually sold for domestic use or consumption then this clause shall not exempt them from the application of any of the provisions of this act.

Sec. 13. That nothing herein shall be understood or construed as prohibiting the enactment or enforcement of weights and measures laws or ordinances by the various states or cities, and the various states or cities shall have the same powers as though this act were not in force and effect: *Provided, however,* That no standard weights or measures shall be established for the uses set out herein which conflict in any way with the standards established herein, and such standards which may already have been established shall be null and void for the uses set out herein.

Sec. 14. That the word "person" as used in this act shall be construed to import both the plural and singular, as the case demands, and shall include corporations, companies, societies and associations. When construing and enforcing the provisions of this act the act, omission, or failure of any officer, agent, or other person acting for or employed by any corporation, company, society or association, within the scope of his employment or office shall in every case be also deemed to be the act, omission, or failure of such corporation, company, society, or association as well as that of the person.

Metal Cutting Tools of Cast High-Speed Steel

By S. H. Bunnell

The granular structure of high-speed steel when cast into tool shapes gives to the metal unusual strength and endurance under heavy cuts. The high-speed alloys are, however, extremely hard to cast without defects, so that the practical use of cast tool blanks has been impossible. The problem has been at last solved by the use of the electric furnace and a special heat treatment, devised within the last two years. By this process, which is the property of the U. S. High-Speed Steel and Tool Corporation, of Green Island, New York, high-speed steel alloys are made from simple metals or alloys by a single melting in the electric furnace and cast directly into cutter blanks of any desired shape.

The alloy in use for this purpose is a vanadium-tungsten-chrome mixture. The several components are charged into the furnace with a flux which assists the combination of the metals. The molds are formed of a core mixture, baked in ovens as usual. These molds are placed on edge and clamped together in series, the flat back of one forming the cover for another. The alloy steel is poured by tilting the furnace into hand ladles and thence to the molds.

After cooling the runners are cut off the castings which are then annealed and made ready for the machining operation.

The first operation is to grind the flat faces close to the desired finishing size, leaving a suitable allowance for the finish-grinding later. If a casting is defective the flaws are invariably disclosed by this grinding, for experience has shown that high-speed alloy castings showing a clean surface after grinding are always sound throughout. The following operations of boring, turning, cutting teeth, keyseating and rough grinding are as usual.

The tools are heated in small gas furnaces provided with electric pyrometers. Quenching is done without the slightest care as to the manner in which the heated cutters are placed in the bath, and yet the tools do not crack in hardening or cooling.

SHOP EQUIPMENT NEWS

-Edited By-
S. A. HAND

SHOP EQUIPMENT • NEWS •
A weekly review of modern designs and equipment

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

• CONDENSED • CLIPPING INDEX
A continuous record of modern designs and equipment

Brown & Sharpe High-Speed Milling Attachment

A high-speed milling attachment recently brought out by the Brown & Sharpe Manufacturing Co., of Providence, R. I., for use on milling machines of their manufacture, is shown in the illustrations; Fig. 1 showing it in position, and Fig. 2 a rear view of the attachment separately. No auxiliary fixtures are required. The bracket and spindle support is a one-piece casting for attaching to the machine, designed to protect the mechanism from dirt and injury.

The attachment is built in two sizes: No. 1 for the smaller, and No. 2 for the larger machines. The No. 2 size is adaptable by means of adjustable gib stops to the larger machines having columns with different widths of face.

To assist in locating it vertically, the attachment is provided with a locating segment, seen in Fig. 2, which rests upon the spindle box of the machine. This spindle box projects beyond the face of the column and acts as a centering guide. The horizontal position is determined by first tightening the gib on the right-hand side, thereby locating the attachment. The gib on the left-hand side clamps the attachment to the face of the column.

The only gearing is the large ring gear that fits on the tapered spindle nose of the machine and the pinion

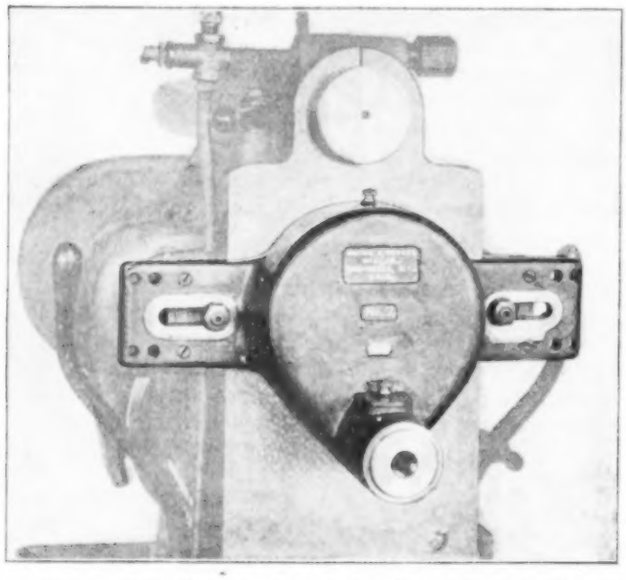


FIG. 1. BROWN & SHARPE HIGH-SPEED MILLING ATTACHMENT

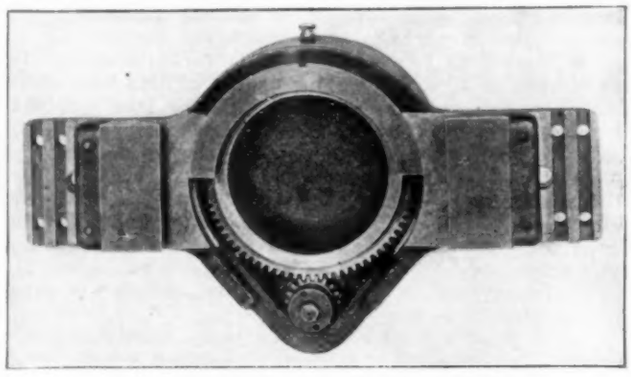


FIG. 2. REAR VIEW OF ATTACHMENT

on the attachment spindle. The large gear is made with an internal taper, ground to fit the nose of the machine spindle and is held in position by the regular cutter driver. This gear is made of machinery steel and left soft to insure a smooth drive and eliminate chatter and the objectionable "ring" often produced by hardened gears at high speed. On the No. 2 attachment the pinion is heat treated and keyed to the attachment spindle while on the No. 1 attachment the teeth of the pinion are cut directly on the spindle.

The spindle is hardened and ground and runs in a long phosphor-bronze bearing, the bearing being tapered so that wear is taken up by tightening an adjusting nut, thereby forcing the spindle into the taper. Once having adjusted the spindle a small setscrew clamps the adjusting nut in position. End thrust is taken by hardened steel and babbitt washers located directly behind the shoulder on the front end of the spindle. The front end of the spindle has a taper hole to receive cutters, the smaller attachment having a No. 7, and the larger one a No. 9 taper hole. Oiling of the spindle bearing is taken care of by means of a wool-filled oil pocket on the front of the attachment.

The cutter is held in position by the taper in the spindle and is driven by the tenon. Cutters are removed by a releasing bolt that is a part of the attachment and remains in the spindle.

Heald Style No. 80 Internal Grinding Machine

The Heald Machine Co., Worcester, Mass., has added to its line of grinding machines the No. 80, a front view of which is shown in Fig. 1. This machine is designed to grind comparatively long holes of small diameter.

The work-head is belt driven from an intermediate

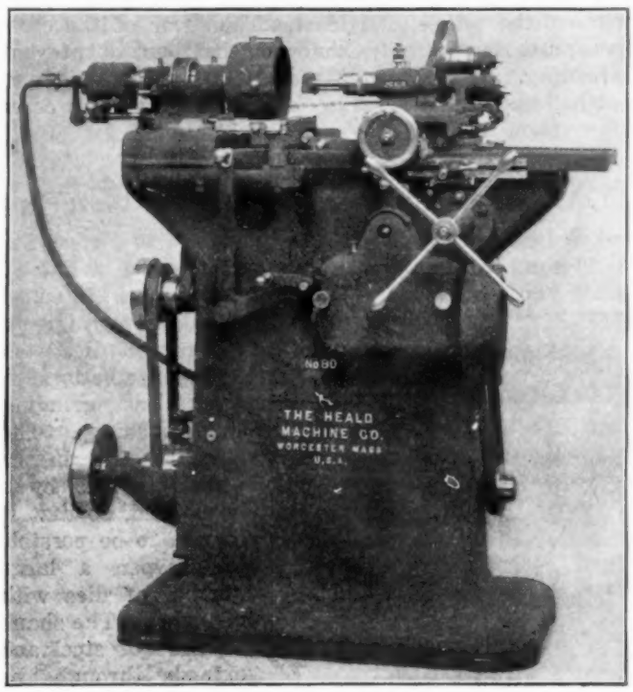


FIG. 1. HEALD STYLE NO. 80 INTERNAL GRINDING MACHINE

Specifications: Swing, 6 in. inside of water guard; 10 in. with water guard removed. Length that can be ground, 3¾ in. Diameter that can be ground, from 1¼ in. to 2 in. Wheel table has two traverse speeds, 34 and 78 in. per min. respectively. Work-head has three rotative speeds, 180, 325 and 590 r.p.m. respectively. The work spindle has a ⅜-in. hole clear through. The center line of the spindle is 46 in. from the floor. Front bearing of work spindle is 1⅜ in. and the rear bearing 1¾ in. in diameter. The countershaft which, together with one grinding head, assortment of grinding wheels, and the necessary wrenches, is included in the machine equipment, runs at 600 r.p.m. and has a pair of tight and loose pulleys 10 in. in diameter by 2¾ in. face. The pump and water tank are extra. Floor space occupied is 28 by 56 in. The net weight of the machine is 1,300 lb.; crated for domestic shipment, 1,600 lb.; and boxed for ocean shipment, 1,800 lb.

pulley mounted on a stud at the end of the base, the crossed driving belt coming up through a cored space in the overhang. The intermediate pulley is integral with a three-step cone by means of which three work speeds are provided for the spindle. The spindle runs in dust-proof bearings that are adjustable to compensate for wear.

The work-head is mounted upon a swivelling base that is graduated up to 45 deg., and to 4 in. per foot. The main drive pulley is connected to its shaft through a friction clutch and provided with a brake, both of which are so connected with the wheel-slide that when the latter is drawn back both the work and the pump are automatically stopped. At the same time, and without attention from the operator, a small guard swings over the grinding wheel to protect the operator from injury due to accidental contact. No time need be lost in gaging the work, or in substituting another piece for the finished one.

The wheel-slide, or table, is reciprocated by a pinion at the upper end of a vertical shaft, driven through a double friction clutch under control of the operator. By shifting a single lever the traverse is changed from power to hand movement, without the possibility of both being engaged at the same time. This enables the operator, as soon as the grinding wheel is clear, to run the slide back quickly for the purpose of gaging or removing the work. This table slides upon flat and V ways. The power traverse may be set to any desired point of reversal. The table drive is through a two-step cone, thereby providing two rates of wheel traverse.

At the wheel end the spindle runs in a bronze tapered bearing that allows for adjustment to compensate for wear. At the pulley end a ball bearing is provided. The wheel-heads are made up as complete units, each having its own pulley, thereby insuring correct spindle speeds. A section through one of these wheel-heads is shown in Fig. 2.

The cross-slide may be operated by power feed or by hand, and the power feed is so calibrated as to work to half thousandths of an inch on diameters. The overhead countershaft, supplied with the machine, has an idler to keep an even tension on the belts.

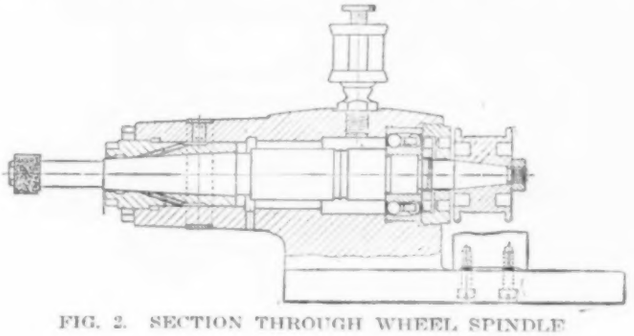
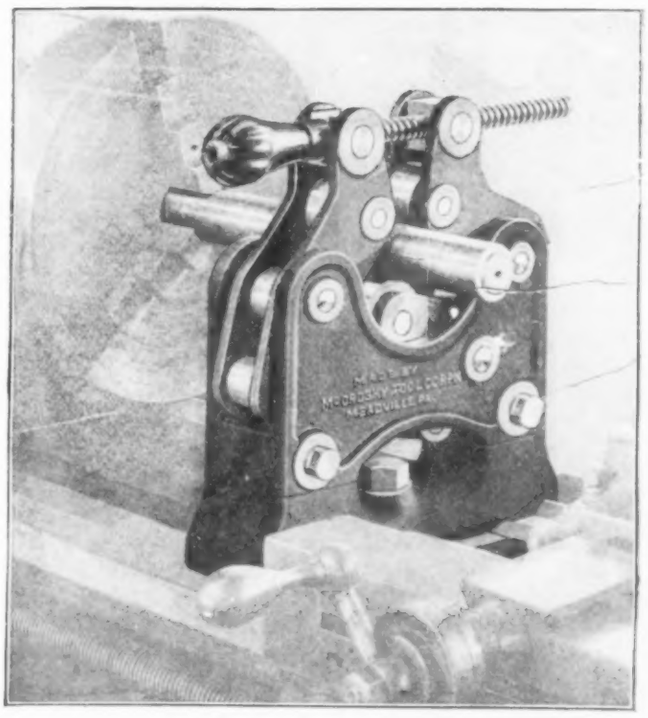


FIG. 2. SECTION THROUGH WHEEL SPINDLE

McCrosky Steadyrest

The steadyrest shown in the illustration has been placed on the market by the McCrosky Tool Corporation, Meadville, Pa. It is especially recommended for use in all operations performed on the end of a piece, such as facing, boring and turning. The work is held between three hardened rollers running on Hyatt roller bearings. For soft work, however, stationary cast-iron jaws can be furnished.

The rollers move toward the center simultaneously upon closing the jaws, the work having been inserted from the top with the jaws open. The handle end of



McCROSKY STEADYREST

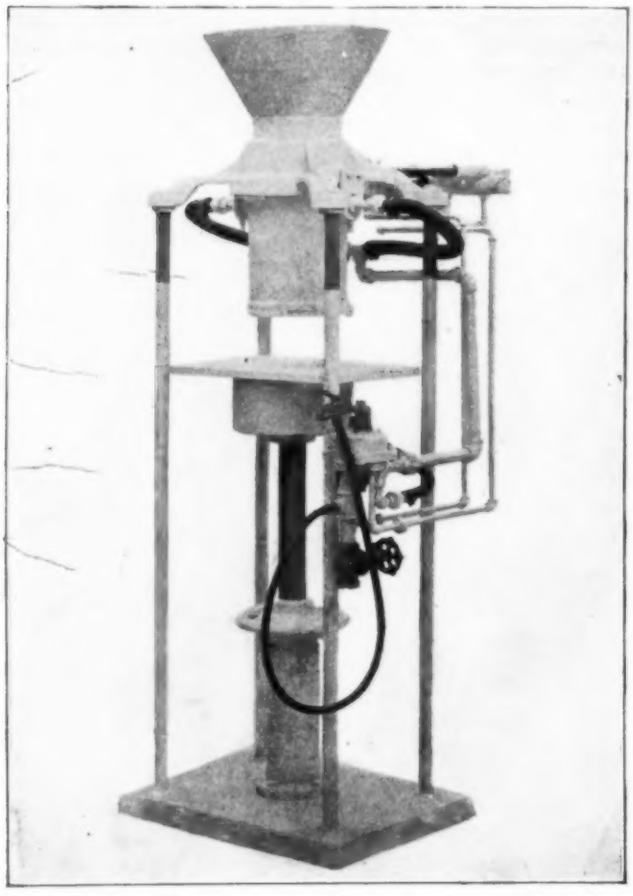
the screw is then dropped into the slot in the front jaw and the device tightened by turning the screw. The device can be easily attached or removed from the lathe, but when once adjusted for the position of the centers on the lathe on which it is used, no readjustment is required. Size 1 is intended for use on lathes having about 12 to 18 in. swing, and it handles work from $\frac{3}{8}$ to $3\frac{3}{4}$ in. in diameter. It weighs about 60 lb.

Woodison "Cappell" Core Machine

The E. J. Woodison Co., Detroit, Mich., has placed on the market the Cappell core-making machine shown in the illustration. The machine is operated by compressed air, a pressure of 80 lb. per square inch being recommended. It is intended for use in making sand cores, particularly those of complicated shape. The core boxes are placed on the table, which has a manual adjustment vertically of 18 in. The sand pot is 8 in. in diameter and holds about $\frac{1}{2}$ cu.ft. of sand.

With the sand hopper filled and the corebox in place, when the operating handle is turned, the sand is allowed to fall into the sand pot, which is then automatically closed at the top by means of a plate. The corebox is forced tightly against the sand pot by means of the air cylinder under the table. When the lever is returned to its original position, the sand is forced out of the pot and into the corebox by air pressure, the top and the sand pot being then opened again.

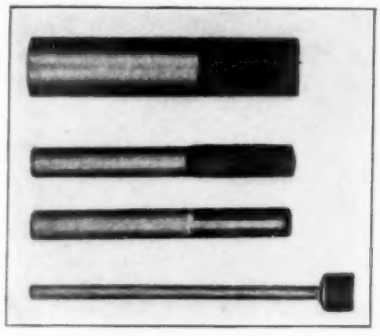
Aluminum coreboxes are especially recommended by the makers because of the ease in handling them. It is stated that the action of the sand does not wear the boxes perceptibly, since it is merely forced in without the action of a blast. The parts of the corebox must be securely clamped together to prevent spreading. It is claimed that the machine consumes but little air, operates very rapidly, and produces cores of uniform density and good finish.



CAPPELL CORE MACHINE MADE BY E. J. WOODISON CO.

Dawsearl Abrasive "Finger" Wheels

The Dawsearl Tool and Machine Co., 390 Forest St., Arlington, N. J., has placed on the market a line of small abrasive "finger" wheels. They are intended especially for regrinding button dies, and are applicable to such work as grinding small bushings. The abrasive used in the wheels is held by a hard bond, so that it is said to be possible to sharpen a large number of dies with one wheel. The shank is made of steel and extends through the center of the abrasive so as to support it. The illustration shows several types of finger wheels. The one at the top is $1\frac{5}{8}$ in. overall the cutting surface being $\frac{3}{8}$ in. in diameter and $\frac{5}{8}$ in. long. The one below it is similar except that it is $\frac{7}{16}$ in. in diameter. It can be seen in section in the next view, the rod in the center extending up to within $\frac{1}{16}$ in. of the end of the abrasive. The rod insures rigidity, but is small enough to allow of considerable elasticity. The wheel shown at the bottom is 2 in. long overall, $\frac{1}{4}$ in. in diameter and $\frac{5}{16}$ in. long on the cutting face, and $\frac{3}{32}$ in. in diameter, on the shanks. The wheels are intended for use on small high-speed portable grinding machines, since they must revolve at a speed of 30,000 r.p.m. or more.

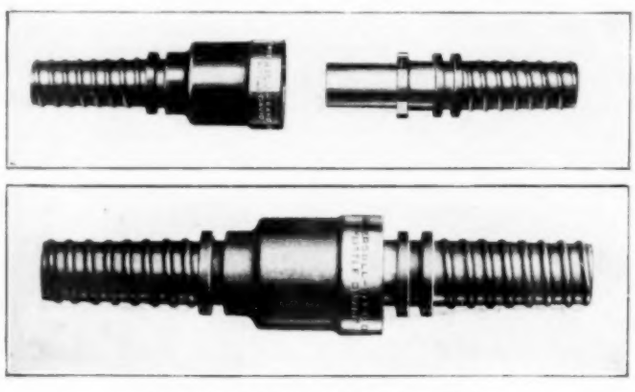


DAWSEARL ABRASIVE "FINGER" WHEELS

"Little David" Hose Coupling

The Ingersoll-Rand Co., 11 Broadway, New York, has recently placed on the market a hose coupling, called the "Little David," which will be distributed as an accessory to the line of "Little David" pneumatic tools manufactured by the same company.

The "Little David" coupling is designed with the view to overcome the trouble due to leakage and the jamming or sticking because of slight injury. Its main features



"LITTLE DAVID" HOSE COUPLING

are said to be sturdiness and simplicity, an all around ability to stand abuse without affecting its service, the absence of an outer sleeve exposed to injury, and a replaceable locking spring. It is claimed that the parts are made of a metal not subject to ordinary rusting or corrosion.

The female end is fitted with a V-shaped rubber gasket to provide an air-tight joint. The gasket is prevented from blowing out, should the coupling accidentally be disconnected under pressure, by a protective shoulder inside the coupling. The female end has no exposed parts which might be liable to injury that would cause jamming or sticking.

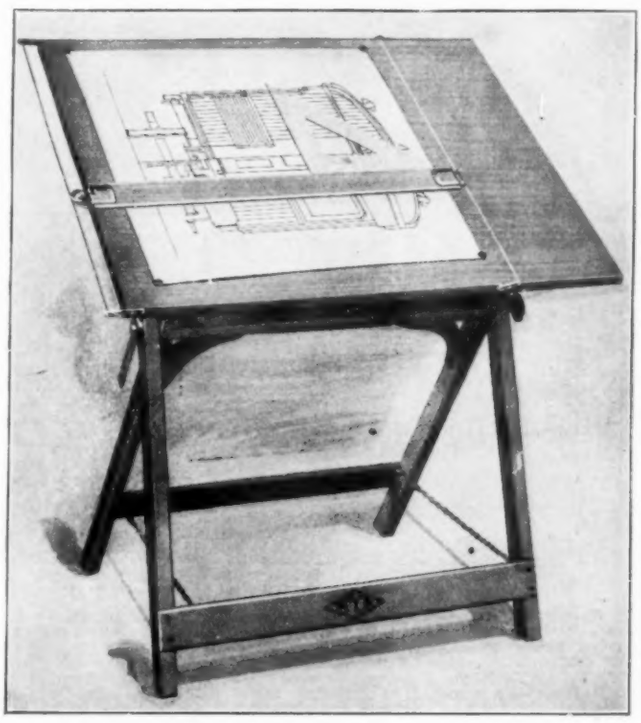
The air ports are straight and of uniform diameter to offer least restriction to the passage of air. The coupling may be connected or disconnected by a quarter turn. A groove in the hose end of each part allows the use of a clamp to attach it to the hose.

"Little David" hose couplings are manufactured in ½-in. and ¾-in. sizes, which are interchangeable; that is, a ½-in. male piece may be used with a ¾-in. female end or *vice versa*. Gaskets are also interchangeable between the different sizes.

"Precise" Parallel-Ruling Attachment

The New York Blue Print Paper Co., 102 Reade St., New York City, has recently placed upon the market a parallel-ruling straight-edge, shown in the illustration. It is applicable to drawing boards of any size, and need not extend the full width of the board. One end of the straight-edge carries a single pulley and the other a double pulley, a silk cord extending across the board at each end of the straight-edge. There are no cords under the board, and the ones running parallel with the straight-edge are enclosed in it.

When a straight-edge shorter than the board is used, ink and drafting tools can be placed on the bare space without interfering with the action of the attachment.



"PRECISE" PARALLEL-RULING ATTACHMENT

The straight-edge may be quickly adjusted to any angle desired. The metal parts are made of aluminum, the whole attachment weighing only about 2 oz. Straight-edges can be furnished with either transparent crytalloid, mahogany, ebony, or hardwood edges, and in lengths of 24, 30, 36, 42, 54 or 60 inches.

Universal Crane

The Universal Crane Co., successors to the International Crane Co., Swetland Building, Cleveland, Ohio, has recently placed on the market a small crane, operated by a gasoline engine, that can be mounted on railroad

THE UNIVERSAL CRANE ON AUTOMOBILE TRUCK

trucks, motor trucks, trailers, etc.; or upon a pedestal if desired for stationary service. In the accompanying picture it is shown upon an automobile truck and in use for the purpose of setting telegraph poles.

The crane swings through the full circle. It has high speeds for hoisting and rotating, and, when suitably mounted, for traversing. The control levers are conveniently mounted so that the operator has all movements under command without moving from his position and has an unobstructed view in all direction. A 40-hp. gasoline engine furnishes the power.

The crane has a lifting capacity up to 4 tons, dependent somewhat upon the mounting and the working radius. The dimensions of the crane unit exclusive of boom and mounting are: Length at level of operator's platform, 8 ft. 6 in.; width, 7 ft.; height, from mounting line to top of cab, 8 ft.

It can be equipped with grab bucket, electromagnet, hoist-block, nigger-head, capstan, steam-shovel or post-hole digging attachments as desired.

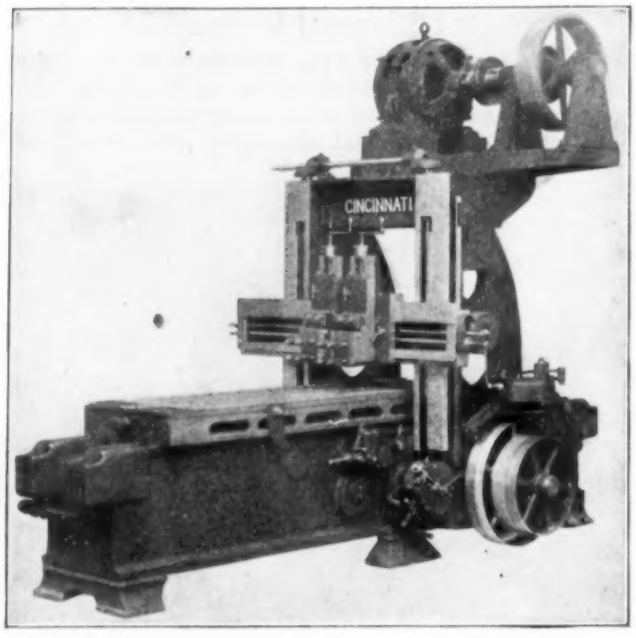
Cincinnati 30-in. Shoe and Wedge Planer

The illustration shows a shoe and wedge planer recently placed on the market by the Cincinnati Planer Co., Cincinnati, Ohio. The machine is intended for heavy-duty work, and is made with large bearing surfaces, steel herringbone gears and forced lubrication.

The bed is of box construction, and cast closed on the top for its entire length, except where the bull-wheel meshes with the rack. The table is of deep box construction, and the upper half of it has the holes for the stops drilled entirely through it, so that

chips drop through and do not have to be dug out. The lower half of the table is cast solid, so that the dust and chips cannot reach the V-ways, but can be cleaned out from the sides.

The housings extend to the bottom of the bed and are fastened to it both by bolts and dowel pins and by



CINCINNATI 30-IN. SHOE AND WEDGE PLANER

tongues and grooves. The bushings are tied together at the top in the usual way. The cross-rail carries but one saddle holding two heads. The heads must travel cross-wise in unison, but provision is made for moving them vertically independent of each other, by either hand or power.

The machine can be arranged for motor drive, either plain or variable speed, or equipped with a two-speed countershaft.

Hercules 24-In. Gear-Hobbing Machine

The Hercules Machine and Tool Co., Inc., Broome and Lafayette Sts., New York City, has added to its line of gear-hobbing machines the 24-in. automatic machine shown in the accompanying illustration. The machine is intended for the quantity manufacture of medium-sized gears, either worm, helical or straight-toothed, such as used for automobile transmissions and machine-tool drives.

The base and column are of box construction and cast in one piece. The table carrying the work slides horizontally on the base, and is equipped with a power feed. The work can be clamped to the circular table or mounted on a vertical arbor set up in the center of it. The table is provided with a rim for the collection of the chips and the coolant.

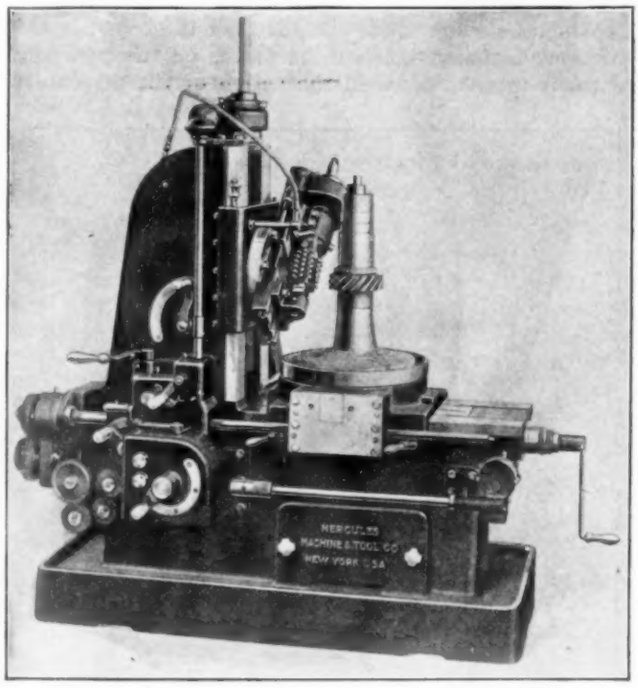
The spindle carrying the cutting hob is hardened and runs in bronze bushings, one of the bearings being conical. The position of the hob can be adjusted along the slide on which it is mounted, so as to permit of the centering of any tooth when setting up. In addition, the hob spindle can be swiveled 90 deg. to either side on its carriage mounted on the ways of the column.

The drive is from a single, inclosed, constant-speed pulley on the side of the machine not shown in the illustration. Speed changes are obtained by means of a quick-change gear box, the gears running in oil. The drive is transmitted through the column by means of a vertical shaft, and then to the spindle head by means of helical gears, thus bringing the hob spindle close to the column.

By means of the quick-change gears, feed changes can be made, the gears being inclosed and running in oil. The feed can be applied either to the vertical travel of the hob carriage, as for most work, or to the horizontal travel of the work table, as when cutting worm gears. In both cases, stops are provided for automatically controlling the extent of the travel. The hob carriage is fed by means of a revolving nut on a screw rigidly attached to the carriage. A rapid traverse is provided for the movement of the hob carriage.

The work spindle is indexed by means of a worm-wheel and hardened worm provided with a suitable adjustment for wear. Its movement is controlled by a separate feed mechanism, being varied by means of change gears at the rear of the machine.

It is claimed that the machine can be very easily set up for the cutting of helical gears, because of the fact that the feed and the indexing are handled by different mechanisms, but connected by a differential mechanism, situated at the rear of the machine. The change gears to obtain the proper rate of indexing are calculated in the same manner as for straight-toothed spur gears, while the gear for use in the differential mechanism can be ascertained by means of a formula. It is possible to change the feed while the work is being cut, because the helical angle is automatically kept constant by a corre-



HERCULES 24-IN. GEAR-HOBBING MACHINE

Specifications: Capacity in steel, to 4 D.P. Maximum size of work; diameter, 28 in.; width, 12 in. Distance from center of work arbor to center of hob mandrel, minimum, 1½ in. Speed of drive pulley, 360 r.p.m. Hob speeds: number, 9; range, from 37 to 150 r.p.m. Feeds, headstock (vertical) and work table (horizontal); number, 8; range from 0.005 to 0.100 in. per revolution of work. Power required, 3 hp. Floor space, 36 x 60 in. Weight: net, 4,000 lb.; domestic shipping, 4,250 lb.; export shipping, 4,350 lb. Export box, 96 cu.ft.

sponding change in the indexing rate. After the work is completed, the entire machine is automatically stopped, so that it is possible for one attendant to operate several machines.

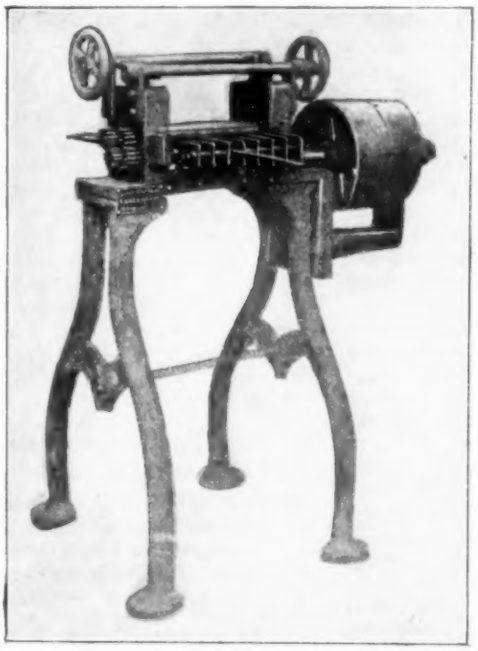
A coolant system, with a pump having a capacity of 10 gal. per minute, is provided. A bracket is furnished for bracing the work arbor. The necessary wrenches and change gears are also provided.

Kane & Roach No. "A" Straightening Machine

The straightening machine shown in the illustration, and known as the No. A machine, has recently been added to the line of Kane & Roach, Niagara and Shonnard Sts., Syracuse, N. Y. It is intended especially for straightening hacksaw blades, file blanks, knife blanks, or strip material stamped out of flat sheets and requiring straightening cold both before and after tempering. Pieces as short as 3 or 3½ in. can be handled.

It is a 4-roll machine, the upper rolls being adjustable and the upper rolls as well as the lower rolls being driven by gears. The first pair of rolls takes out the bends and irregularities and the last ones do the final straightening. In order to care for work of different thicknesses, the rolls are made with seven steps, increasing in size from one end.

When setting up, the rolls are usually set so that stock of standard thickness will be straightened on the center step. There are then three steps on one side for use when the stock is thicker than the standard, and three on the other side for thinner stock. The operator is usually enabled to judge by the feel or the weight of



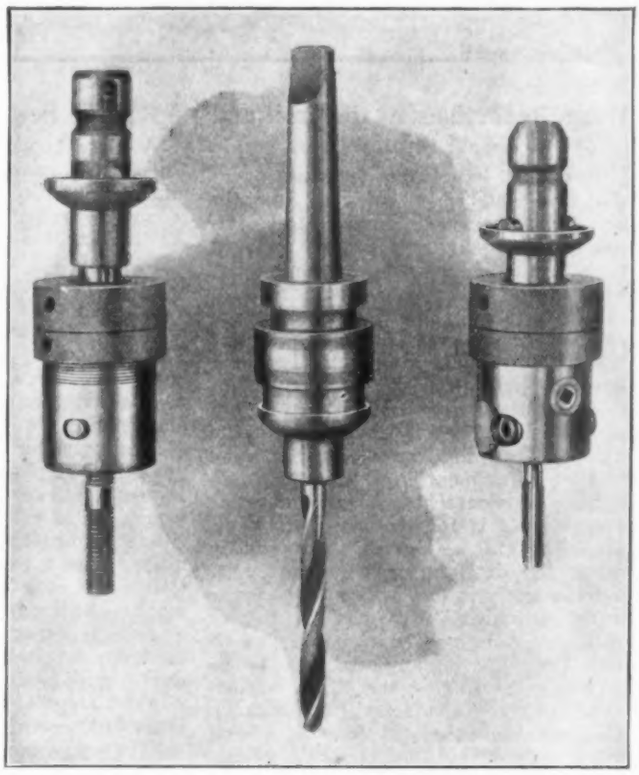
KANE & ROACH NO. "A" STRAIGHTENING MACHINE

the piece as to which step it should be fed into in order to straighten it.

Guides are provided so that the work is held in the proper position for passing through the rolls and so that it cannot move from one step to another. The machine requires only ¼ hp. to operate it, and occupies a floor space of 24 x 36 in.

Jarvis Quick-Change Chuck and Collets

The illustration shows a type of quick-change chuck and collet recently put on the market by the Charles L. Jarvis Co., Gildersleeve, Conn. The device is intended for use where different operations, such as drilling,



JARVIS QUICK-CHANGE CHUCK AND COLLETS

reaming, counterboring, tapping and stud-setting, are done with one spindle, especially when working on heavy castings with a radial drilling machine. They are adapted to lathe use also.

The chuck can be furnished with the type and size of taper required to fit the spindle of the drilling machine. The collets are short, are made from hardened drop forgings, have two radial bearing surfaces, and are driven by means of a pin placed close to the work, as can be seen by the two collets fastened to key-operated jaw chucks, shown at each side of the illustration. It is claimed that the collets can be easily inserted.

The tool is made in three sizes. The standard sizes of the chuck shank are from No. 2 to 5 Morse taper, the holes in the collets from No. 1 to 4 Morse taper, the diameters of the collets from 1 to 2 in., and the largest diameters of the chuck from 2 to 4 in.

Obtaining the Radius of Three Equal Inscribed Circles

A typographical error in an article by Leo A. Brennan, under the above title, appearing on page 593 of the *American Machinist*, has been called to our attention by Eric H. Tyler. The two lines appearing as

$$R + C = R + 0.57735$$
$$R = 1.57735 = B$$

should read $R + C = R + 0.57735\ R$
$= 1.57735 = B,$

the R being misplaced.

SPARKS FROM THE WOR

Valentine Francis

Wage Reductions in the Iron and Steel Industry

The most important development in the iron and steel industry recently was the acknowledgment by steel companies that wages would be reduced from 15 to 25 per cent beginning the first of the year. This was foreseen some time ago when these companies commenced lowering their prices of finished steel products and finally came down to the same level as was established by the Industrial Board in March of last year. At this level many of the independent mills were losing money and an adjustment in production costs became a necessity. As the labor at these plants is for the most part paid according to an established sliding scale, the drop in prices operated to automatically reduce wages, but as the mills continued to pay at the higher rate the trade was in a quandry as to how long the higher rate was to be maintained. During the past week officials of the Midvale Steel & Ordnance Co., the Lackawanna Steel Co. and other independents announced a reduction in wages of from 15 to 25 per cent beginning the first of the year.

Announcement was made of a reduction from 46 to 38 cents an hour at four Ohio Valley plants of the Wheeling Steel Corporation, with elimination of extra pay for time over eight hours. Judge E. H. Gary of the United States Steel Corporation declined to make any comment on wage reductions, nor would he give any indication as to the policy of the corporation. The open shop policy is maintained at most of the plants of the leading interest and wages are not paid on the sliding scale, and even if they were this interest still adheres to the former schedule of prices and is not confronted by the same adverse change in ratios of selling prices and production costs. It is anticipated in many quarters, however, that the corporation will soon announce a cut.

Revised Government Wage Rates

In the revised reclassification bill, which is now under preparation, it is understood that the following basic rates have been agreed upon for machinists in the Government service: Machinist, general, 80 cents per hour; automobile machinist, 90 cents per hour; printing-office machinist, $1 per hour; mechanic, office appliances, $1,500 to $1,860 per annum; automobile repair man, 55 cents to 65 cents per hour; blacksmith, 75 cents per hour; tinsmith and sheet-metal worker, $1 per hour; foundryman, 75 cents per hour; motor-truck driver, from $1,140 to $1,260 per annum.

Banker Sees Bright Outlook

"With a population of more than 100,000,000 people whose daily needs must be satisfied, there can be no prolonged period of depression," declares A. Burton Hepburn, chairman of the advisory board of the Chase National Bank. "It is true that there are considerable stocks of goods in the country, but they soon will be liquidated. The outlook for 1921 certainly is most hopeful and I anticipate normal business activity on a sound basis of cost and credit."

In discussing the outlook for next year, Mr. Hepburn said: "So far the improvement consists mainly in the psychological change in the public's attitude toward business. Changed conditions have made business men realize that there is a community of interest among them which must be respected and the prosperity of all safeguarded in order to insure the prosperity of each. Any business man is in a sorry plight unless obligations owed him by other business men are good.

"There is evidence of future easing of the money market. It comes from an undesirable cause, curtailment, the liquidation of business; but this must eventually ease the money market. The public is on strike against paying the high prices asked by retailers of goods—manufacturers, wholesalers and retailers have on hand quantities of goods made from raw materials at high prices which they naturally wish to dispose of without loss. There must be liquidation, but in the present temper of the public it can easily be brought about without disaster.

"We have over a hundred million people whose current wants must be supplied. Manufacturers should continue to make goods from raw materials and reduce prices—merchants should supply themselves with these goods in sufficient quantities to supply public needs. I have confidence in the good sense and good judgment of the American public and believe we will reach a lower and more stable level of prices without serious disaster."

Mr. Hepburn pointed out that with living costs becoming less, labor can afford to accept a reduction in wages.

Exchange Dealings With Russia Sanctioned

Restrictions over transactions involving Russian rubles and the exportation of coin to Soviet Russia were removed on Dec. 20, thus lifting one of the chief bars to trading with Russia.

Action to this effect was announced by the Treasury Department.

Will Tabulate Farm Equipment Manufacture

A census which will show the number and value of different items of farm operating equipment manufactured in the United States during 1920, the number sold in the United States, and the number sold for export, is being undertaken by the United States Department of Agriculture. Information will be collected from the manufacturers of farm implements, vehicles, and other equipment.

Since 1916 the department has compiled yearly reports showing the production and sale of tractors on information supplied by manufacturers to the Office of Farm Equipment Control, and later to the Division of Agricultural Engineering. In order to meet the continued demand for similar figures regarding other machinery and equipment, it has been decided to collect information concerning the manufacture and sale of all important items.

The co-operation of the manufacturers, who generally realize the value of such statistics to their industry, has been assured. The Division of Agricultural Engineering of the Bureau of Public Roads, which is to have direct charge of the collection of this information, has been assured through the National Implement and Vehicle Association of the co-operation of its members. The present plan is to send to each manufacturer of farm equipment a form on which to report by mail the manufacture and sale of different items by his firm during 1920. The department wishes it to be clearly understood that it will follow its usual custom of keeping the reports of the individual manufacturers confidential, and that they will be used for no other purpose than that outlined.

New Bodies Represented on A. E. S. C.

The following is a corrected list of the four new member-bodies, and their representatives, of the American Engineering Standards Committee:

U. S. Department of Agriculture: C. L. Alsberg, Chief, Bureau of Chemistry; Earle H. Clapp, Forest Service; T. H. MacDonald, Chief, Bureau of Public Roads.

U. S. Department of the Interior: E. A. Holbrook, Assistant Director, Bureau of Mines; O. P. Hood, Chief Mechanical Engineer, Bureau of Mines; P. S. Smith, Administrative Geologist, Geological Survey.

Gas Group (American Gas Association, Compressed Gas Manufacturers' Association, International Acetylene Association): A. H. Hall, superintendent of distribution, Central Union Gas Co.; A. C. Morrison, vice-president, Compressed Gas Manufacturers' Association; H. S. Smith, president, International Acetylene Association.

American Electric Railway Railway Association: (Official representatives not yet designated).

LD'S INDUSTRIAL FORGE
News Editor

German Statistics on Exports and Imports Cause Much Comment

Much comment has been given to the export and import statistics submitted at the conference in Brussels by the German delegates. These figures, it is said, would make it appear that the German foreign trade is on the way to show a balance on the right side. In 1919 the import was by 22 billions of marks larger than the export. In April, 1920, however, the export appeared to be 500 millions and in May 1,100 millions higher than the imports. It is said that these figures are misleading, and that the increase is mainly due to the fact that exporters speeded their shipments during those two months in anticipation of the export tax which came into force on the first of July. It was further mentioned, that, while the statistical office is able to compile exact figures as regards export values this is not the fact with regard to imports. Importers are not compelled—as are the exporters—to make declarations in all cases as to the value of their dealings and import figures are therefore mainly obtained by estimate, which, as has been found, has been much too low.

It has further been asserted that the figures for foreign trade submitted at Brussels have evidently been compiled with a view to give a favorable impression of the German trade situation not corresponding with actual facts.

Although the arguments brought forward are right to a certain extent it is believed that they emanate from quarters which are continually at work to demonstrate the impossibility of fulfilling the economical conditions of the Peace Treaty. From a comparison of the figures of exports in 1919 and 1920 it appears that from January, 1920, the import has slowly decreased, while the export has risen from January, 1919, in a steady curve up to May, 1920. The figures since May, 1920, have not been made public yet, but it is believed that they will show a considerable decline, not so much because of the alleged advance shipments made in April and May but on account the business depression.

A new labor act which provides for an 8-hour day in all factories and workshops has gone into effect in Holland. Sunday work is forbidden for youths and women, and can only be allowed for men by special arrangement with the Minister of Labor. Saturday work after 1 p.m. is governed by the same conditions, a rule which establishes 45 hours as the working week.

Conventions To Get Lower Fares

Reduced fares on account of conventions will be granted by some railroads in 1921. The discrimination against business and trade organizations which was observed during the period of Governmental operation of the railways has been abolished.

In a letter to the Merchants' Association of New York, under date of Dec. 16, C. M. Burt, chairman of the passenger department of the Trunk Line Association, writes as follows:

For your information it has been decided by the Trunk Lines to grant reduced fares for conventions to be held next year on the basis of fare and one-half with minimum of $1 for the round-trip, on the certificate plan, conditioned upon an attendance of 350 or more members, including dependent members of their families traveling to the meeting by rail, and the reduction will be applicable to all societies or other organizations qualifying under the rules.

Within the territory of the Trunk Line Association are all stations in Delaware, the District of Columbia, and New Jersey, and it also includes most of the stations in the States of New York, Pennsylvania, Maryland, Virginia and West Virginia.

Indications point to similar action on the part of the other territorial rail passenger associations.

Express Combine Approved

The Interstate Commerce Commission recently approved the consolidation of the Adams, American, Wells Fargo & Co. and the Southern Express Co. into the American Railway Express Co. The application of the American Railway Express Co. for the approval of the consolidation had been under consideration by the commission since last August. Commissioners McChord and Meyer dissented.

The principal objection to the consolidation, which was effected during federal control of the railroads, being approved by the commission was the attitude of the Adams and Southern Express companies toward the settlement of loss and damage claims. The protestants, which included representatives of many shippers and the state commissions, urged that if the commission approved the consolidation it should fix as a condition precedent thereto provisions which would protect the rights of claimants.

Give thought to your spending. Resolve to save part of your income by regular investment in Government Savings Securities.

Make a resolution to invest in Liberty Bonds and Victory Notes. Buy all you can afford. The current market prices make them an advantageous buy.

More Funds Needed for Bureau of Standards

Pointing out that the Bureau of Standards is giving valuable assistance to many industries which would warrant its maintenance if for no other reason S. W. Stratton, director of the bureau, in his annual report made public on Dec. 19 urges more adequate support through Congressional appropriations.

Mr. Stratton summarizes the needs of the bureau as follows:

Attention is again called to the necessity for adjusting the salaries of the scientific and technical experts of the bureau to compare more favorably with those paid by scientific and industrial laboratories, as well as educational institutions. It is to be regretted that this adjustment could not have been made during the year, since all scientific work of the Government has suffered to a greater or less extent. The demand for men capable of undertaking scientific and technical investigations is far greater than the supply; this, coupled with the present rate of compensation in Government work, has lowered the standard of workers available and greatly impaired the quality as well as the quantity of work. The number of changes in personnel during the year has been many times that under normal conditions. Here, again, the result has been decreased efficiency and a reduction of output.

The power of Bureau of Standards is entirely inadequate. It consists of the original plant, designed to supply two buildings, and two temporary boiler plants, added later. These installations should be combined in one plant capable of heating the various buildings. It should also provide the various electrical currents for power and experimental purposes, as well as the refrigeration, compressed air, vacuum, and other utilities required in scientific work.

The Government method of purchasing materials and supplies of all kinds by means of competitive bids often leads to injustice to the manufacturer and loss of money to the Government unless based upon correct specifications, methods of testing, and the testing of deliveries.

The direct assistance given by the Bureau to the industries along these lines would alone warrant its maintenance many times over. During the war the Bureau co-operated with the military departments in researches of many kinds. During the past year a special fund was provided for such co-operation with the industries and an analysis of the results will leave no question as to the usefulness of or necessity for such work by the Bureau. The funds available for this purpose during the coming year are entirely inadequate and it is earnestly recommended that in submitting the estimates for the next year a suitable fund be requested for co-operation with the industries in scientific research.

S. A. E. Winter-Meeting Programs

The annual meeting of the Society of Automotive Engineers, as already announced in our "Forthcoming Meetings" section, will be held in the Engineering Societies Building, New York City, on Jan. 11 to 13, inclusive. The program follows:

TUESDAY, JAN. 11

Standards Meeting—Discussion of the revisions of additions to prevailing S. A. E. Standards and Recommended Practices which will be reported by the Divisions of the Standards Committee.

Aeronautic Session—Technical meeting to consider the recent engineering develop-

wings, metal construction, internally trussed ments in aircraft, such as variable camber wings, retractable chassis, and propellers. Authoritative papers to be presented on these topics.

WEDNESDAY, JAN. 12

Annual Business Meeting — Election of officers for coming year. Finance, Membership, Meetings, and other Committee reports.

The Engineer's Place in the Industry—A definition of the increasing influence of the engineer in industry, the greater responsibility which he must assume, and the necessity for his building confidence around his undertaking. Presented by three prominent executives of the automotive industry.

Body Engineering Session—The genesis of a closer co-operation between engineers engaged in this automotive work. Consideration to be given to tendency in design, construction and methods of production. Encouragement of standardization in this field and reduction of body weight.

Aeronautic Session—The development of commercial aviation using both lighter and heavier-than-air types. Presentation of the progress of air transport in Europe, and study of its future possibilities in America.

Chassis Session—Increasing the efficiency of the automotive chassis to conserve fuel. Study of mechanical losses, advisability of smaller engines and higher axle ratios, reduction of sprung and unsprung weight. Possibility of European types of small cars in America.

"The Carnival"—The social event of the S. A. E. year! Colorful, mirthful, sensational. The annual reunion of the S. A. E. family, where members, wives and sweethearts revel in an environment of music and dance.

THURSDAY, JAN. 13

Fuel Session—Discussion of efficient utilization of present high endpoint gasoline in internal combustion engines. Analysis of valuable research in the phenomena of combustion and detonation. Employment of increased compression pressure with knock eliminated. Consideration of combustion and flame propagation. Distribution problems. The petroleum refiner's viewpoint. Extent and effect of crankcase dilution. Symposium of the leading authorities' present views.

Highway Session — Effect of the heavy automotive vehicle on highway surface. The study of subsoil and its relation to surface durability. A meeting to further develop co-operative contact with the civil engineer who builds and maintains the roadbed on which our products operate.

The Annual S. A. E. Dinner—(*Hotel Astor at 7 o'clock*)—The formal climax of the Meeting, when engineer, producer and salesman dine in fraternal spirit, exchange stories of the early days of our dynamic industry and hear words of wisdom spoken by eminent leaders in American business. The largest single gathering of representative men in the automotive industry.

CHICAGO MEETING

The Chicago meeting will be held on Feb. 2, 1921 at the Hotel Morrison. There will be a morning and an afternoon session. One will be devoted principally to the consideration of truck-design trend, introducing a paper on an interesting steam-truck development. The other session will deal with the operation of automotive vehicles from the viewpoint of the service man and the owner, offering an opportunity for the operator to criticize the engineering errors in design. A dinner will be held in the evening.

COLUMBUS MEETING

On Feb. 10, 1921, there will be a Columbus meeting at the Hotel Deshler. Two technical sessions devoted to the consideration of farm power engineering will be held. Trend of tractor design, plowing and belt speeds, and faults developed in Nebraska State trials will be discussed. Stationary farm engines for lighting, pumping and utility uses will also be considered. This meeting will end with an evening dinner.

Artificial Seasoning of Gage Steels

The investigation on the effects of various artificial seasoning treatments on the permanence of gage steels by the Bureau of Standards, Washington, D. C., has progressed sufficiently far to permit the drawing of certain conclusions. In this work hardened gages were heated in oil at various temperatures and under varying time conditions, and also subjected to seasoning by alternate dipping in hot oil and iced brine. The results of the work are as follows:

(1) Short gages (½ in.) showed no appreciable changes in length, with or without various artificial seasoning treatments, over a period of approximately seven months beginning about one to two weeks after hardening. In general the long gages (2 in.) showed no appreciable changes in planeness.

(2) For studying length changes with time, gage blocks of greater length than those used (2 in.) would be desirable. About 6 to 8 in. is recommended.

(3) Duplicate gages show wide variations in length changes; for example, one block showed no dimensional change in 217 days between first and last measurements, while a duplicate decreased 0.00018 in. in length in the same period.

(4) Except in the case of plain-carbon steel containing 1.18 per cent carbon, the changes in planeness are not appreciable. In this steel relatively large variations in planeness for duplicate gages are noted.

(5) Gages produced from stainless steel and ordinary drill rod are softer than reference blocks ordinarily produced and which are kept between about 90 to 100 Shore hardness. From this standpoint the stainless steel is unsatisfactory as it is not possible with ordinary treatment to maintain the hardness within the limits described. A higher-carbon alloy of this type would be more desirable, with possibly a decrease in chromium such as would not impair its stainless qualities and at the same time reduce production costs.

(6) The plain-carbon steel (containing 1.8 per cent carbon) appears to be the least desirable from the standpoint of permanence, showing in the main the greatest changes in length and planeness during a period approximately seven months from first to last measurements. Probably the most desirable are steels HC and K subjected to definite seasoning treatments, the former being the steel now generally used in production of reference gages at the Bureau of Standards.

(7) Measurements at intervals of approximately one week, one, two, four, and seven months after initial readings of length and planeness do not give very much information regarding the progress of the changes taking place. Where the greatest changes occur in either length or planness they appear to progressively increase with time. In many cases where these changes have been smallest over the entire time interval they seem to occur in the intervals immediately following the first measurement, the gages thereafter remaining constant.

Iowa's New Machine-Tool Company

The Bertschy Engineering Co. of Cedar Rapids, Ia., organized in May, 1920, has just completed the installation of a large machine-tool equipment. This company, which started business in July, 1920, purchased the buildings, property, equipment and supplies of the Peerless V-Belt Co. of Cedar Rapids, Ia.; from the Mattison Machine Works of Rockford, Ill., it purchased the metal working shaper business which had been conducted by the Rockford Co. for several years. In addition to these it also purchased the Bermo welding-apparatus business from the Bertschy Manufacturing and Engineering Co. of Omaha, Neb.

The new Iowa company began its production activities in October, 1920, and has now on hand castings, parts and materials which are in process of manufacture for 16-, 20- and 24-in. heavy-duty back-geared shapers. The entire output of the machine-tool department is covered by orders, and preparations are being made to extend this department to take care of the increased business. In the welding apparatus department it is claimed that upward of five thousand complete welding equipments and a large number of additional Bermo welding torches are in process of manufacture. In the belt department, where the silent-chain V-belt is manufactured, the demand far exceeds the company's ability to supply.

The company at the present time employs a large force of men; it is working full time, and all the overtime that is possible. The directors of the company are: A. J. P. Bertschy; George S. Wright, Council Bluffs, Ia.; Glenn M. and Arthur T. Averill, Cedar Rapids, Ia., and E. B. Poff.

C. W. Couch Organizes Sales Agency

C. W. Couch, recently sales manager of the Ford-Clark Co., has recently perfected a selling organization under the name of C. W. Couch & Co., with headquarters at 614 National City Bldg., Cleveland, Ohio.

Among the firms for whom the new organization will act as direct selling agents will be found such names as the Perry-Fay Co., Elyria, Ohio, manufacturers of screw machine products; the City Brass Foundry Co., Cleveland, Ohio, manufacturer of aluminum, brass and bronze castings; the Superior Metal Products Co., Elyria, Ohio, manufacturer of pressed and drawn steel parts; the Marquette Metal Products Co., Cleveland, manufacturers of hardened and ground steel bushings.

If you are on the right tack the winds and tides are with you and will get you there in the end—if you don't give up—*Forbes Magazine* (N. Y.).

Bullard's Third Christmas Party a Success

The third Christmas party for the children of the employees of the Bullard Machine Tool Co. of Bridgeport was given in the Bridgeport Casino on the evening of Dec. 22. The children of every man who had been on the Bullard payroll during 1920 were invited and the wards of the Bridgeport Protestant Orphan Asylum were also included.

The Casino, which has a seating capacity of 3,500, was jammed, 2,200 of those present being children. Each child was given a box with presents suited to his age and sex. There were four classifications—boys from one to six years of age, girls from one to six, boys from seven to ten and girls from seven to ten—and judging from the noise that followed the opening of the boxes the selections had been well made.

The program began with the singing of Christmas carols. Stanley H. Bullard then made a short address of welcome and presented the members of the factory bowling team with watch fobs for winning the city championship. Mr. Bullard was answered by Master Charlie Gvory, aged twelve years, who, aided by a megaphone, delivered the following speech of his own composition:

Ladies and Gentlemen:

I am a pupil of the Holland Hill School, Fairfield, and my father works for the Bullard Machine Tool Co. in that town.

This is the third time that the Bullard's have given us an entertainment and I have been waiting for someone to thank them for it, but as no one else does I can't wait any longer without telling my own feelings.

We did not expect anything this year because the work has been so slow, but we are glad to know that Bullard's did not forget the children whose fathers are working for their organization.

We all owe to Santa Claus and Bullard our greatest thanks for what he has done for us in giving us presents.

I am not ashamed to say I am a Hungarian boy and I hope to work for Mr. Bullard myself when I am old enough, because he has a good heart toward the working people. I, myself, do not think you could find an organization as good as the Bullard Tool Co. in any part of the United States.

Again I wish to thank them, and I wish every one here a Merry Christmas and a Happy New Year.

A few tableaux followed and led up to the arrival of Santa Claus, who brought joy to the hearts of the smaller children for the rest of the evening by dancing with them singly and in groups.

Manufacturers' Associations Meet

Formation of a National Board of Adjustment said to be demanded by the railway brotherhoods to handle all labor problems instead of the individual company settling its own troubles, as formerly, will be protested at a convention of manufacturers, merchants, railway executives and shippers at Chicago, Jan. 12, which will be held at the Congress Hotel.

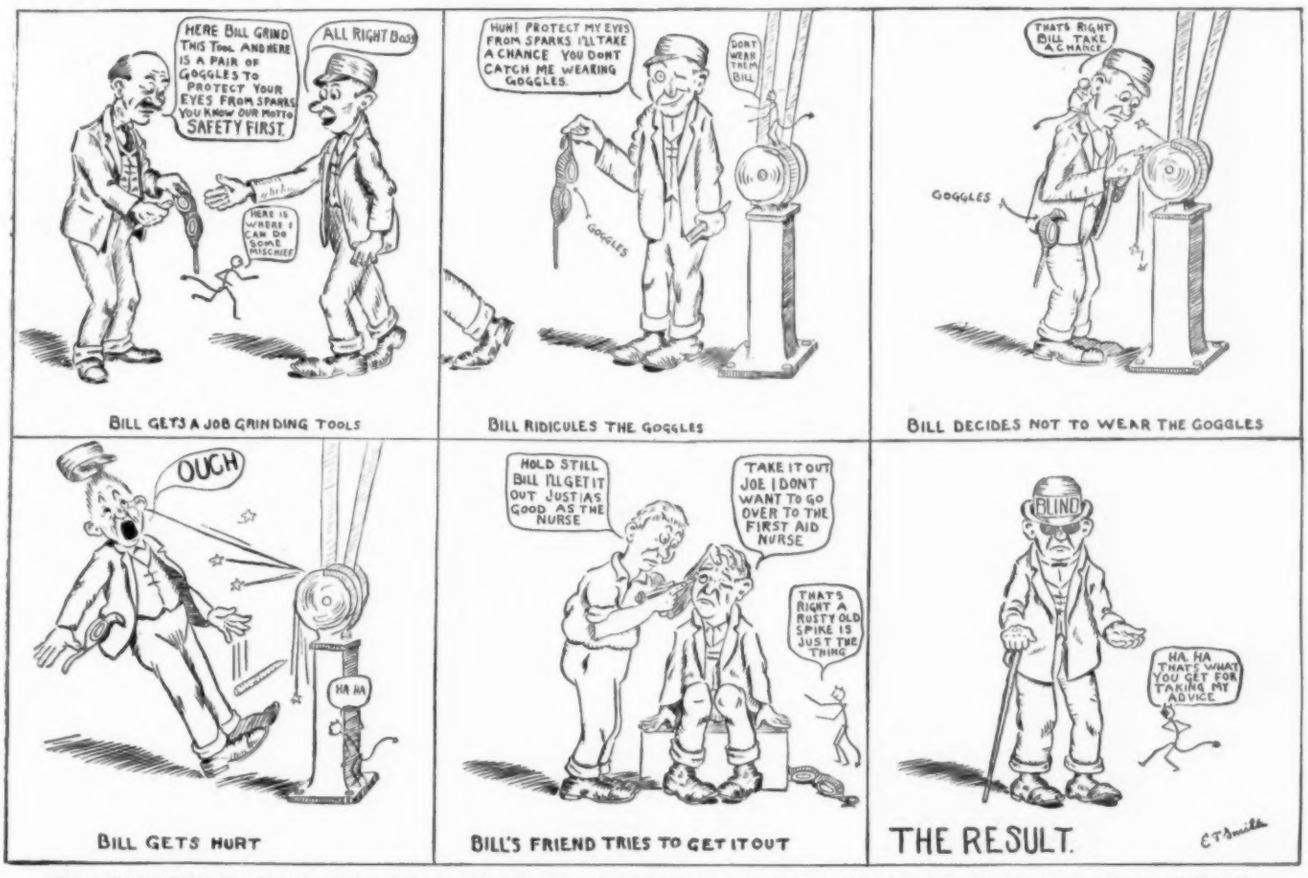
Acquiescence in the railway brotherhoods' plan would mean the opening wedge for collective bargaining and the closed shop in all branches of American industry, according to the convention call issued yesterday by the National Conference of State Manufacturers' Associations, through its president, William Butterworth, who is also a director of the Illinois Manufacturers' Association, vice-president of the Chamber of Commerce of the U. S. A., and the president of Deere & Co., Moline, Ill.; and the secretary, John M. Glenn, who holds the same position with the Illinois Manufacturers' Association.

Orders 200,000 Tons of Steel Rails

The Pennsylvania Railroad announced on Dec. 23 the placing of an order for 200,000 tons of steel rails, divided among the United States Steel Corporation and independents. The Illinois Steel Co. and the Carnegie Steel Co., Steel Corporation subsidiaries, were awarded 50,000 tons each, while 45,000 tons went to the Bethlehem Steel Corporation, 45,000 tons to the Midvale Steel and Ordnance Co. and 10,000 tons to the Lackawanna Steel Co.

Awarding of the order followed almost immediately upon the reduction in the price of open-hearth rails to the level of the Steel Corporation—namely, $47 a ton. Previously the independents had been quoting $57 a ton and $59 a ton for bessemer rails.

Deliveries, it is understood, will begin some time in the spring. This is one of the largest orders ever placed by the Pennsylvania, and will be used principally for renewals. Last year there was used for renewals 106,000 tons. The new rails will make up part of the deficiency that accumulated during the period of Federal control.


HERE BILL GRIND THIS TOOL AND HERE IS A PAIR OF GOGGLES TO PROTECT YOUR EYES FROM SPARKS YOU KNOW OUR MOTTO SAFETY FIRST
ALL RIGHT BOSS
HERE IS WHERE I CAN DO SOME MISCHIEF
BILL GETS A JOB GRINDING TOOLS
HUH! PROTECT MY EYES FROM SPARKS I'LL TAKE A CHANCE YOU DONT CATCH ME WEARING GOGGLES.
DONT WEAR THEM BILL
GOGGLES
BILL RIDICULES THE GOGGLES
THATS RIGHT BILL TAKE A CHANCE
GOGGLES
BILL DECIDES NOT TO WEAR THE GOGGLES
OUCH
HA HA
BILL GETS HURT
HOLD STILL BILL I'LL GET IT OUT JUST AS GOOD AS THE NURSE
TAKE IT OUT JOE I DONT WANT TO GO OVER TO THE FIRST AID NURSE
THATS RIGHT A RUSTY OLD SPIKE IS JUST THE THING
BILL'S FRIEND TRIES TO GET IT OUT
BLIND
HA HA THATS WHAT YOU GET FOR TAKING MY ADVICE
THE RESULT.
C T Smith

THIS CARTOON WAS DRAWN BY E. T. SMITH, A MACHINIST AT THE BUFFALO WORKS OF THE KING SEWING MACHINE CO., FOR ONE OF ITS SAFETY BULLETINS

Big Gains in U. S. Trade With Africa

While certain European nations have been readjusting boundary lines and territorial control in Africa, the manufacturers of the United States have been successfully invading the markets of that continent. Our exports to Africa, says a statement by the National City Bank of New York, in the year which ends with this month will aggregate six times as much as in 1914, and our imports from that continent seven times as much as in 1914. Our total trade with Africa in the calendar year 1920 will aggregate 325 million dollars, against 47 millions in the fiscal year 1914, all of which preceded the war.

Manufactures of all sorts, but especialy automobiles, mining machinery, cotton goods, iron and steel manufactures, electrical machinery, boots and shoes, clothing, and household requirements of all sorts are the principal articles exported to Africa, automobiles alone amounting to about $7,000,000 in the calendar year 1919 against 2½ millions in the preceding years.

Cancelled Contracts in England

In the London *Times* appears the following regarding England's feeling toward cancellations:

"No good purpose would be served by ignoring the fact that the cancellation of contracts is causing a good deal of feeling. We have passed through a time of very great difficulty, and we fear it must be admitted that those difficulties are by no means ended. During the past few years not only have prices been rising rapidly but supplies have been extremely hard to obtain, and in their anxiety to get goods for their customers merchants and importers abroad have sometimes been inclined to order more than they really required in the hope that they would get sufficient for their purpose.

"A year ago order books were bursting and manufacturers in many cases were unable to guarantee date of delivery or price—hence the much-discussed variation clause. Today conditions have entirely changed, and merchants and importers are threatened with delivery of goods bought at a high price for which they can only secure the lower market prices now ruling. In these circumstances some contracts have been cancelled. We cannot for a moment justify such a practice. The sanctity of contract is the basis of business, and in the past many a merchant has incurred immense loss rather than go back on his word, even if there were nothing whatever in writing to seal it and the only evidence of a contract was the recollection of an offer and acceptance by word of mouth. Unhappily, that is not a universal standard of honor.

"In the United States of America—if we are to accept the views of the American Chamber of Commerce in London—the speculator thinks he is doing a natural thing in "getting out from under" when markets are falling. It is not suggested that reputable American houses take this view, but it seems that during the scramble of the last few years a speculative element has been introduced, and we must remember that these gentlemen have usually very slender resources. Indeed, it may be that in some cases it is better for the manufacturer in the long run that his contract should be cancelled than that he should deliver the goods and figure as a creditor in a subsequent bankruptcy. Yet, though all these points are deserving of attention, the business world cannot view with equanimity the continuance or extension of so dangerous a practice as cancellation of contracts.

"A manufacturer can obviously make no plans for the future unless he is reasonably sure that ordered goods will be duly accepted and paid for. We see that it has been suggested that manufacturers should be more strict in reducing contracts to legal written form. That seems to us to be a retrograde step. Surely it should be a source of pride to any nation that its business men are so honorable that such precautions become unnecessary. The elimination of formal contracts is far more common than most people suppose, and tends greatly to facilitate the transaction of business. That firms should in these difficult times be more than ordinarily careful as to the standing of those with whom the deal is obvious."

Get the most out of tomorrow by resolving today to invest regularly in Government Savings Securities.

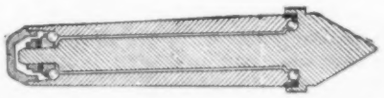
DOMESTIC EXPORTS FROM THE UNITED STATES BY COUNTRIES, DURING OCTOBER, 1920
METAL-WORKING MACHINERY

Countries	Lathes	Other Machine Tools	Sharpening and Grinding Machines	All Other
Azores and Madeira Island	$130			
Belgium	23,569	$21,965	$15,644	$63,498
Bulgaria	9,950			
Denmark		7,557	2,143	725
France	22,620	268,260	10,091	187,359
Germany		250		3,120
Greece	4,305	285	102	10,122
Italy	10,303	35,312	13,680	46,405
Netherlands	15,100	20,520	996	1,614
Norway		14,718	7,039	1,980
Poland and Danzig				649
Portugal	2,579	2,703		900
Roumania	1,142	5,843	1,592	580
Spain	15,278	50,834	7,006	38,963
Sweden	3,263	17,600	9,415	4,632
Switzerland		9,338	1,727	13,421
Turkey in Europe				1,759
England	46,080	269,994	46,686	275,243
Scotland		12,038	673	6,374
Ireland			78	2,235
Bermuda	400	575		
Canada	47,694	126,216	47,513	224,931
Costa Rica		524		
Guatemala	644	1,334	132	160
Honduras		332	14	431
Nicaragua		4	293	
Panama		1,975		
Salvador		13	107	
Mexico	15,861	20,315	3,095	40,908
Newfoundland and Labrador		574		
Barbados	5			
Jamaica		1,449	94	1,397
Trinidad and Tobago		367		10,009
Other British West Indies	1,605	9		
Cuba	17,896	41,065	4,420	27,153
Virgin Islands of U. S.	115			816
French West Indies		22		
Haiti		715	62	
Dominican Republic	2,210	201	482	3,297
Argentina	6,209	4,381	4,211	20,334
Bolivia		370	115	
Brazil	6,992	8,570	3,668	17,862
Chile	1,471	6,480		118,875
Colombia	2,809	4,310	435	4,873
Ecuador	1,568	127	62	
British Guiana			48	
Dutch Guiana	63			
French Guiana		1,278		
Peru	191	2,469	378	29,642
Uruguay	1,402		227	420
Venezuela	2,619	1,774	138	173
China	25,882	37,175	7,131	32,323
Kwantung				4,110
British India	15,063	42,320	5,406	17,121
Straits Settlements		503	90	
Dutch East Indies	768	2,180	769	5,028
Hongkong	566			
Japan	25,066	55,298	40,291	283,364
Turkey in Asia		179		
Australia	16,658	35,175	5,224	17,807
New Zealand	2,165	12,783	897	4,764
French Oceania			44	
Other Oceania				1,283
Philippine Islands	6,125	4,355	2,997	10,194
British West Africa		721	45	
British South Africa	1,453	11,979	2,526	16,652
British East Africa		702		
French Africa		37		
Madagascar				1,401
Morocco		194		
Portuguese Africa		1,875		
Egypt	269	936		
Total	$358,088	$1,170,075	$247,788	$1,556,908

Condensed-Clipping Index of Equipment

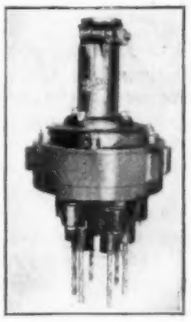
Patented Aug. 20, 1918

Center, "Frictionless," Ball-Bearing
Snellex Manufacturing Co., Rochester, N. Y.
"American Machinist," Dec. 2, 1920.



The device is intended to decrease friction between the work and the center, to make it unnecessary to regrind center points, and to eliminate the wearing and burning of center holes in the work. The general construction of the center can be seen in the illustration. The ball race at the rear end is held in place by a lock-washer and check-nut, and it is protected by an oil cap. The device is regularly made in four sizes, from Nos. 1 to 4 Morse taper, other sizes being made to order.

Drill Heads, Multiple-Spindle, "Buhr"
Nelson-Blanck Manufacturing Co., Dubois and Clay Sts., Detroit, Mich.
"American Machinist," Dec. 2, 1920.

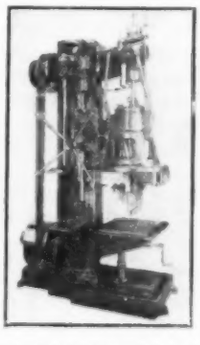


The illustration shows head No. 16-F, which has six spindles, although heads having any number of spindles from three to twelve are made. The head is manufactured with four capacities. The smallest, or high-speed machine, running at 5,000 r.p.m., is equipped with No. 1-A Jacobs chucks taking drills up to ¼ in. in diameter. The next size is equipped with No. 1 Morse taper holes in the spindles, and can handle drills up to ⅝ in. in diameter. The heads having No. 2 Morse tapers will accommodate ¾-in. drills; while the largest size, having No. 3 Morse tapers, will carry drills up to 1¼ in. in diameter.

Measuring Machine, Gear Pitch and Concentricity, "Wickman"
Alfred Herbert, Ltd., 54 Dey St., New York
"American Machinist," Dec. 2, 1920.

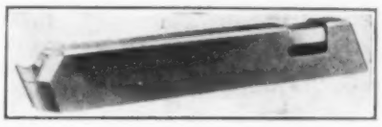
This machine measures the tooth spacing on the pitch line and the concentricity of the pitch line with the central bore on which the gear rotates. The gear to be tested is mounted on a taper arbor held down by a draw-bolt. The arbor is rotated through a worm and wheel, the worm having a graduated dial on its shaft from which readings can be taken. Both the worm and the wheel are hardened, and are finish-lapped to pitch and form, their accuracy being within 0.0001 in.

Tapping Attachment, Multiple-Spindle
Fox Machine Co., Jackson, Mich.
"American Machinist," Dec. 9, 1920.



The machine shown is of the D-22 type equipped for drilling and tapping, the tapping mechanism being applicable also to the D-12 and D-32 types of drilling machines. It is necessary that some changes be made in the machines when they are equipped for tapping, the drive-shafts being mounted on ball bearings. It is stated that the machine illustrated has tapped twelve ⅝-in. holes in cast-iron plates 1½ in. thick in five seconds, a maximum of 6 hp. being consumed. The positions of the spindles carrying the taps can be changed to suit different layouts for different jobs.

Toolholder, "Wilkes"
Dawson Tool Corporation, 51st and Lancaster Ave., Philadelphia, Pa.
"American Machinist," Dec. 2, 1920.

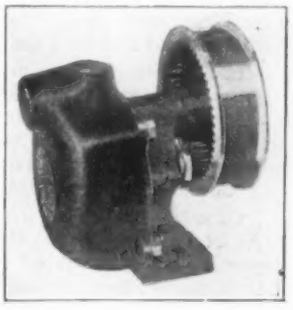


The holder is intended for heavy-duty, high-speed work, the point of the cutting tool being supported by a projection of the holder underneath it. No setscrew is used to hold the tool, the clamping action being obtained by means of the nut at the rear end of the holder. Because of the absence of a setscrew, the front of the holder can be passed through the toolpost. It is claimed that the holder will stand very severe use, and that it holds the tool so securely as to decrease chatter. The body is heat-treated. The holder is made in a range of sizes to take tools from ⅜ to 1 in. in size.

Truck, Self-Loading, Electric, "I.T.C."
Industrial Truck Co., Holyoke, Mass.
"American Machinist," Dec. 2, 1920.

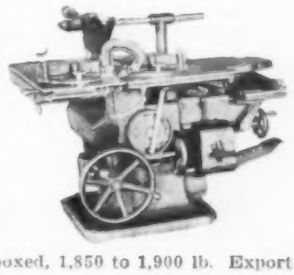
The truck has a turning radius on the extreme outside point of 7 ft. 10 in. and is said to be capable of being operated in intersecting aisles 60 in. wide. Specifications: Capacity, 5,000 lb. Loading platform: length, 55 in.; width, 26 in.; height lowered, 11 in.; height raised, 15½ in. Driving motor: 24 volt; 50 amp.; 1,500 r.p.m. Elevating motor: 24 volt; 35 amp.; 1,800 r.p.m. Gear reduction, 17½ to 1. Speeds: 3 forward, 3 reverse. Wheel diameter: driving end, 20 in.; trailing end, 10 in. Turning diameter: outside wheel, 14 ft. 3 in.; outside point, 15 ft. 8 in. Wheelbase, 59¾ in. Height, 51 in. Width, 36 in. Length: overall, 102 in.; step raised, 91½ in. Weight: without battery, 2,150 lb.; with Edison battery, 2,600 lb.; with lead battery, 2,700 lb.

Pump, Centrifugal, "Two-Way," Coolant
Ross Manufacturing Co., 3160 West 106th St., Cleveland, Ohio
"American Machinist," Nov. 25, 1920.



The pump can be run in either direction. The liquid is delivered from the same orifice no matter in which direction the impeller is rotated. The pump is belt-driven, the pulley having an internal gear on its rim. This gear drives a gear on the impeller shaft, the speed ratio being 1 to 4. The four-bladed impeller is made of spring steel. It is claimed that, because the inlet is at the top, the impeller is always submerged and consequently primed. The pump delivers a large volume of coolant and can be used to serve a battery of small machines. It can also operate with a slight suction lift.

Saw, Bench, "No. 80, Variety"
Oliver Machinery Co., Grand Rapids, Mich.
"American Machinist," Dec. 9, 1920.



This machine will do ripping, cross-cutting, dadoing and gaining, and can be furnished with a special table equipment that permits it to be used for boring and mortising. Specifications: Table; universal or plain, 36 x 44 in. Universal table; tilts to 45 deg.; movable section, 15-in. wide; vertical adjustment, 4 in. Capacity; ripping, 23 or 27 in. wide; cross-cutting, 32 x 3 in.; dados, 4 in. wide; mortising, ¾ x 4 in.; boring, 2 in. diameter by 6 in. Saw arbor, 1 in. diameter. Driving pulley; 600 r.p.m.; 18 x 5 in. Motor drive; 5 hp.; 1,800 r.p.m. Weight; crated, 1,650 to 1,700 lb.; boxed, 1,850 to 1,900 lb. Export box, 60 cu.ft.

Clip, paste on 3 x 5-in. cards and file as desired

Star Brass Works Changes Name

The Star Brass Works, 3114-26 Carroll Ave., Chicago, manufacturers of spray cooling systems and painting and spraying machinery, announces that on and after Jan. 1, 1921, the company name will be changed to Binks Spray Equipment Co. This change of name has been made to conform more nearly with the nature of the products manufactured. Simultaneously announcement is also made of the completion of a new plant and office extension on the old plant in which provisions are made for new salesrooms, testing laboratories, and greatly increased manufacturing facilities on the first floor, with new offices and drafting rooms on the second floor. The new addition was necessary by reason of the rapid expansion of the business in all lines.

Personals

HARRY H. BADGER, for several years superintendent of the tool division of the Stanley Insulating Co. at Great Barrington, Mass., has recently resigned.

JOHN T. CHIDSEY, president of the American Piano Supply Co. of New York, and president of the Root Co. of Bristol, Conn., has recently been honored by being elected president of the Chamber of Commerce of Bristol, and a member of the Board of Directors of Connecticut Chamber of Commerce.

LEON E. THOMAS, president of the Reading Iron Co., has been elected president of the Eastern Pig Iron Association. Mr. Thomas was at one time connected with the United Engineering and Foundry Co. of Pittsburgh.

F. K. COPELAND, president of the Sullivan Machinery Co., Chicago, Ill., has been named new national councillor of the Compressed Air Society of New York, to represent it in the Chamber of Commerce of the United States.

GEOFFREY C. BROWN, formerly with the Northern Electric Co., Montreal, is now superintendent of manufacturing, Habirshaw Electric Cable Co., Yonkers, N. Y.

SAMUEL W. DUDLEY, at present chief engineer of the Westinghouse Airbrake Co., has been chosen professor of mechanical engineering on the Strathcona Foundation by the Yale Corporation, it was announced recently.

W. C. RICE has become general manager of the Frontier Machine Tool Co. of Buffalo, N. Y., manufacturer of drilling machines, power hack saws and grinding machines.

According to *The Journal of Commerce*, New York, German state railroads are to be removed from official management and their finances entirely separated from state finances. A private corporation has been formed for their operation. Financial collapse of state management is reported the cause.

Business Items

The Engineering Business Exchange, 30 Church St., New York, announces the opening of a Pacific Coast branch with James T. Whittlesey as director and with offices in the Claus Spreckels Building, San Francisco. This will make available to the engineers and engineering industries of the Coast states the same service in bringing together the buyers and sellers of engineering and technical business properties that is being rendered by the New York office of the Exchange.

The Detroit Belt Lacer Co., Detroit, Mich., announces the completion of its new building. Its new machine department is now in full operation and producing 500 closing machines a month. The addition of eight automatic hook machines will increase the company's production capacity to 50,000 boxes per month.

The Heavy Oil Engine Division of the Dodge Sales and Engineering Co., of Mishawaka, Ind., announces the publication of a small catalog describing Dodge heavy oil stationary engines, Dodge heavy oil marine engines, and Dodge heavy oil engine electric generating units. The catalog is printed on paper of excellent quality and contains fifteen illustrations of the various types of engines described and is now ready for general distribution.

Siemens & Halske, a German concern, received a large order for electric machinery for Chinese mines, railroads and industrial establishments. This order has been secured in competition with American, English and French manufacturers.

The Inland Steel Co., Chicago, announced that on Jan. 1 its plants would return to the ten- and twelve-hour basis a day. Wages will not be changed per hour.

Unconfirmed reports from Queluz, State of Minas, say a manganese mine, the largest in South America was purchased by North American interests from the Morro da Mina Co. for approximately $4,000,000.

Obituary

GEORGE E. TROWBRIDGE, an owner and the general manager of the Whitinsville Spinning Ring Co., of Whitinsville, Mass., and very well known in New England industrial circles, died at his home in Linwood, Mass., Dec. 13, after an illness of six days, from pneumonia. Mr. Trowbridge was nearly 63 years old.

Your will power determines your destiny. Make your New Year resolution to save regularly. Invest your savings in Government Savings Securities.

New Publications

Advanced Shop Drawing. By Vincent C. George, B.S., Instructor in Mechanical Engineering, The University of Wisconsin. 144 pages 6 x 9. 147 illustrations. Published by the McGraw-Hill Book Co., Inc., 239 West 39th St., New York, U. S. A.

A well-written and comprehensive treatise on practical drawing that should be of value to ambitious students who desire to master the art. The author makes no attempt to teach the underlying principles, but assumes that the reader is already familiar with the use of instruments, knows plane geometry, and is ready to apply his knowledge to the practical everyday problems of the shop. The first subject discussed is the matter of titles, lettering, etc., and the practice of various shops is cited. There follow two chapters on gearing in which the technical terms, the mathematical calculations, and the method of laying down the construction on the drawing board are very clearly explained. These chapters include problems in bevel and worm as well as in spur gearing. Isometric, cabinet and shaded drawing are considered in other chapters as are also structural, electrical and patent office drawings, plans for piping systems, sheet-metal work, etc.

Motorcycles and Side Cars, Construction, Management, Repair. By Victor W. Page, M.E. 665 pages, 5 x 7½, 372 illustrations. The Norman W. Henley Publishing Co., 2 West 45th St., New York.

In this volume the author has covered the subject quite completely, showing pictures and giving details of many early experimental models; and following the development down to date. Construction of all standard machines is shown in detail, accompanied by valuable hints on the care and operation of same. Chapters on Lubrication, Carburetion, Ignition, Power Transmission, etc., are given, each including illustrations and careful description of the functions of each part. Final chapters on Maintenance, and Instructions for Complete Over-Hauling, round out a work that every owner of a motorcycle will appreciate.

Modern Welding Methods. By Victor W. Page. Two hundred ninety-two 6 x 9-in. pages, 113 illustrations. Bound in dark red cloth boards. Published by the Norman W. Henley Publishing Co., 2 West 45th St., New York.

The author of this book makes no attempt to cover other than the ordinary practice. The range of the text is so large that only limited details are given of any one subject. The first 34 pages are devoted to a general discussion of the art of joining metals, including soldering, brazing and various forms of welding. Then follow 17 pages on the properties of metals. The next 76 pages and 50 illustrations deal with welding gases, gas producing apparatus, welding appliances, and examples of welding work. The subjects of arc welding, butt welding, spot welding, seam welding, and all the various phases of resistance welding mentioned are put into 49 pages. Seventeen more pages are devoted to Thermit welding, and the balance of the book is made up of text and cuts dealing with soldering and brazing processes and fluxes, forge welding and the heat treatment of steel.

MacRae's Blue Book. Vol. XI, 1920. Eighteen hundred fifty-four 8 x 11-in. pages, including advertisements. Published by MacRae's Blue Book Co., 18 East Huron St., Chicago.

The book is divided into the following sections: Catalog; Address; Classified material; Trade name; Miscellaneous Data; Standard List Price. There are also a discount computer and service post cards.

The Theory of Machines. By Robert F. McKay. Four hundred forty 5½ x 8½-in. pages, 407 illustrations. Bound in green cloth boards. Published by Longmans, Green & Co., New York.

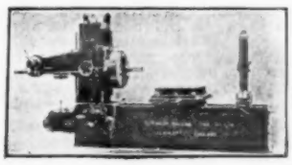
This book covers the theory of machines in a very comprehensive manner. Students, designers and mechanical engineers will find much of value and interest arranged in a logical and easily accessible manner.

After a definitive introduction the author takes up plane motion of a particle; force and torque; work and energy; plane motion of a particle under variable acceleration; displacement; velocity and acceleration diagrams; statics, analysis of motion; synthesis of a machine; examples of mechanisms obtained by inversion; relative linear

Condensed-Clipping Index of Equipment

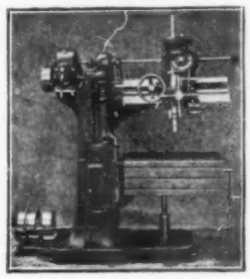
Patented Aug. 20, 1918

Boring Machine, etc., Horizontal, with Automatic Facing Head
Atlas Engineering Co., Leeds, England
"American Machinist" (European Edition), Sept. 11, 1920.



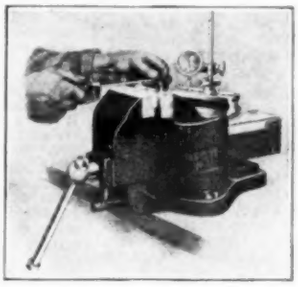
This horizontal boring, drilling, tapping and milling machine has a new facing head. The nine spindle speeds range from 16.6 to 256 r.p.m. and are all reversible. The nine feeds are positive and reversible and range from 0.007 to 0.133 in. per revolution. The machine has also nine speeds to the facing head. Specifications: Maximum distance from spindle to top of the revolving top table, 24¼ in.; from spindle to top of main table, 28⅜ in. Main table, 28 x 45 in.; top table, 28 x 28 in. Cross traverse of table, 30 in.; longitudual, 51 in. Largest diameter faced, 26 in. Weight, 122 cwt.

Drilling Machine, Radial, All-Gear Drive
Pollard & Co., Ltd., Leicester, England
"American Machinist" (European Edition), Sept. 11, 1920.



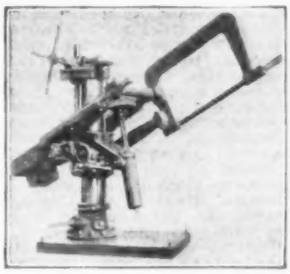
This 36-in. machine has nine spindle speeds which are obtained through sliding gears in the gear box mounted on the column, by means of two levers, each having three working positions. The spindle accommodates No. 4 Morse taper shanks and has a vertical adjustment of 12 in. Speeds, 51 to 750 r.p.m.; feeds, 0.006 to 0.020 in. per turn of spindle; maximum distance from end of spindle to worktable, 24 in.; table surface, 31 x 26 in.; drilling capacity, 1½-in. holes in mild steel; weight, 2,600 lb.

Vise, Bench
Brooke Tool Manufacturing Co., Ltd., Birmingham, England
"American Machinist" (European Edition), Sept. 11, 1920.



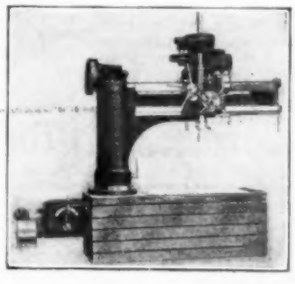
This vise is made with continuous screws or with a quick-action device, which, it is claimed, combines both quick release and continuous screw movements. The cut shows that the vise has a machined surface plate at the back of the fixed jaw, the illustration indicating how this may be brought into use for testing the surface of a flat gage by the use of a dial indicator. The vise is made in three sizes, the smallest with jaws 3¼ in. wide by 3 in. deep, opening 4 in. and weighing 40 lb., and the largest has jaws 4¼ in. wide by 3⅜ in. deep, opening 6 in. and weighing 63 lb.

Sawing Machine, Gate, Radial
E. G. Herbert, Ltd., Manchester, England
"American Machinist" (European Edition), Sept. 11, 1920.



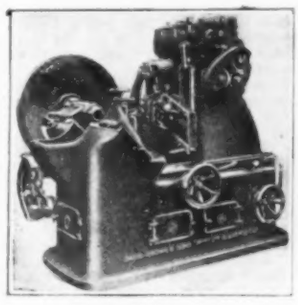
This hacksaw is in the form of a radial gate-sawing machine, and is intended particularly for cutting off gates or runners from heavy steel castings and also from castings in phosphor bronze, manganese bronze, etc. It will cut through a section 24 in. square at any height up to 6 ft. from the ground. The illustration shows the general design, the saw itself being of the flush-side type so that it will make a cut close to the face of the casting; in fact, within ⅛ in., there being no projections on the blade side. The blade is 39 in. long by 2 in. wide. Weight, 3 tons.

Drilling Machine, Radial, 5 ft. 3 In.
Crossley & Co., Manchester, England
"American Machinist" (European Edition), Sept. 11, 1920.



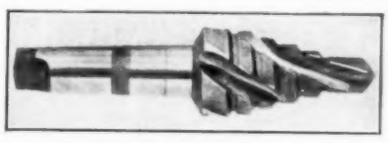
This is a drilling, tapping and boring machine. The box table is 6 ft. 3 in. long, 2 ft. 6 in. wide and 2 ft. 4 in. high. The drive is by constant-speed belt through a gear box of the sliding-gear type, giving six changes; thus, with the double gear on the saddle, twelve spindle speeds are available, ranging from 46 to 401 r.p.m. The spindle is 2¼ in. in diameter on the driving part and 2½ in. in diameter in the sleeve, is bored No. 4 Morse taper, and has ball thrust bearings and locknuts to adjust for wear. It is graduated and has automatic trip motion, the vertical traverse being 15 in. The drive is through a friction clutch.

Generator, Double-Helical
David Brown & Sons, Ltd., Huddersfield, England
"American Machinist" (European Edition), Sept. 11, 1920.



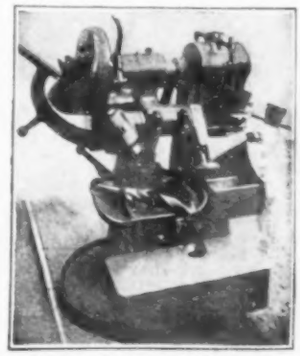
This generator is capable of producing herringbone gears up to 36 in. in diameter by 6 in. face and 1 in. circular pitch or 3 d.p. A rack is employed for generation, or rather two racks, each with straight-sided teeth; one rack for each side of the gear, and each rack travels longitudinally while the blank rotates at the correct relative speed. Simultaneously the rack cutter reciprocates across the face of the blank, thus producing involute teeth. No central gap is necessary in the face of the wheel, as each rack tool cuts right to the apex of the gear.

Drills, Twist, Stepped, "Robertson"
Alfred Herbert, Ltd., Coventry, England
"American Machinist" (European Edition), Sept. 11, 1920.



The tool has a combination of countersinking, recessing and boring facilities. It is designed for plate work, such as boiler and condenser tube holes, etc., the idea being that one step is through the thickness of metal before the other commences cutting. The power required for drilling to the larger diameters is from 20 to 50 per cent less than that required with the first step, or an ordinary twist drill of the diameter of the first step. No special skill is required to operate, and the drills can be had in 3, 4, 5, 6, 7 and 8 steps, the illustration showing a 6-step drill.

Grinding Machine, Twist-Drill
Alfred Herbert, Ltd., Coventry, England
"American Machinist" (European Edition), Sept. 11, 1920.



This machine, with point-thinning attachment, will handle drills from ⅛ to 2¼ in. The thinning attachment is shown to the right, and consists of a V-holder for the reception of the drill. This holder pivots on slides which are adjustable in two directions. The drill reposing in the V, one of its cutting lips supported on an adjustable finger, is adjusted in relation to the wheel so that by the operator moving the holder parallel to the plane of the wheel the lip of the drill travels in a line parallel to the groove to be ground.

Clip, paste on 3 x 5-in. cards and file as desired

velocity and acceleration; determination of the angular motion of links; reciprocating motion of the slider crank chain; straight-line motions; toothed gearing; forms of wheel teeth; involute, cycloidal and pin teeth; helical gearing; non-circular gears; trains of wheels and epicyclic gearing; belts and belting; rope and chain drives; cams; spheric motion; screw motion; friction; static equilibrium of machines; turning-moment diagrams; governors; balancing; brakes and dynamometers.

A valuable feature of the book from the student's standpoint, is that a considerable number of problems and answers are given, affording excellent practice and making clear the text.

Handbook of Mexican Properties and Securities. By J. S. Curtiss. Three hundred ninety 6 x 9-in. pages. Published by J. S. Curtiss & Co., El Paso, Texas.

While primarily this book was intended for those interested in Mexican investments, there is much in it of real value to the American busines man looking into Mexican fields and conditions. Chambers of Commerce throughout Mexico have been liberal in their assistance to the author, who has been ten years gathering his data. The information given covers very fully the mines, estates, cotton plantations and industrial corporations of our sister republic.

After a brief introduction, the book starts out with a list of the states of Mexico, which is followed by a list of the banks there. Next is a detailed list of the various bonds issued by the United States of Mexico. A table covering the past thirty years shows the amount of agricultural products for various periods. The national railways are also given attention. Several pages are devoted to translations of Mexican ranch and mining terms into English. The different division headings of the book, that follow the foregoing information, are: Government Mining Agents in Each State, Regulation of Mining Laws of Mexico, Bureau of American Republics, New Constitution of Mexico in English, Mining Law of Mexico—Complete, Cotton Plantations of Mexico, Mexican Oil Companies, Oil Companies of Tampico and Tuxpan, Refineries in Tampico and Tuxpan Districts, Public Utilities of Mexico, Industrial Stocks of Mexico, Mines and Mining Companies of Mexico, Ranches and Ranch Owners of Mexico.

Safety in the Machine Shop. 188 pages, 6 x 9 in., illustrated. Issued by the Travelers Insurance Co., Hartford, Conn.

In connection with its efforts to reduce the number and severity of industrial accidents, the Travelers Insurance Co. has recently added this book to its accident-prevention series. It is divided into fourteen sections, the first of which sketches the development of the machine shop from the time such an establishment consisted of the proprietor and one or two assistants, up to the present-day shop employing thousands of persons.

In the remaining sections the safety problems that arise in the modern shop are discussed in detail and careful consideration is given to cranes, lathes, automatic machines, grinding apparatus and other machine-shop equipment. In addition to the discussion of safeguarding, and safe-operating methods, subjects indirectly related to accident prevention are considered. One section treats of "Infection From Cutting Oils" and another deals with the subject of proper illumination and its bearing on the accident-prevention problem.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

The manager of an exporting house in Austria desires to secure the representation of firms for the sale of any line of American goods, particularly machines and mechanical articles. Reference. No. 34093.

A trading company in Brazil desires to be placed in touch with manufacturers who desire to extend their business relations with that country, in the sale of automobiles, railway material, agricultural machinery, tools, oils, lubricants, chemical products, fertilizers, cement, construction material, canned goods, etc. References. No. 34094.

A manufacturer in Spain desires to purchase for own account a complete machine and outfit for the manufacture of iron screws of all kinds, capable of producing from 4,000 to 6,000 screws daily. Cash to be paid. Correspondence should be in Spanish. References. No. 34095.

The partner in an import firm of South Africa is in the United States and desires to secure an agency for the sale of equipment for coal-mining plants, house-lighting plants, household refrigerating machines, high-speed steam-generating sets, briquette-making machinery, concrete mixers, centrifugal pumps used for removing gravel, stone-crushing machinery, and electrical household contrivances. Reference. No. 34183.

An inquirer in Mexico, who plans to establish a modern oil refinery, desires to be placed in communication with builders of oil-refining machines. No reference offered. No. 34184.

Trade Catalogs

Lo-Swing Lathe. Fitchburg Machine Works, Fitchburg, Mass. Catalog, pp. 30, 6 x 9 in. This is a single-purpose machine and is designed for the rapid and accurate production of duplicate parts by the use of multiple tools cutting simultaneously. This catalog profusely illustrates it with line cuts and halftones.

Landis Threading Machines. Landis Machine Co., Waynesboro, Pa. Catalog, 8 x 10½ in. This catalog, printed in Spanish, illustrates and describes the company's bolt and pipe threading machinery.

Foundry Molding Machines. Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill. Catalog No. 10, pp. 51, 6 x 9 in. This catalog, No. 10, first edition, compiled by the Hanna Engineering Works, the distributor for the Mumford Molding Machine Co., illustrates and describes its foundry molding machines.

Transformation and Transportation. Lakewood Engineerinng Co., Cleveland, Ohio. Booklet, 5 x 7½ in. The industrial transportation department of this company has recently issued this booklet to bring to the attention of executives the need for greater consideration of the material handling problem.

Shearing Stresses in Reinforced-Concrete Beams. By H. S. Rogers, B. Sc., C. E., and published by the engineering department of the Truscon Steel Co., Youngstown, Ohio. This booklet gives a complete analytical comparison between loose stirrup designs and beams reinforced with rigidly connected shear members. Discussions and tables of many tests are given. Copies of this booklet will be furnished free to interested persons.

Piston Air Drills and Pneumatic Hammers. Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago, Ill. Circular No. 34, briefly illustrates and describes its piston air drills and pneumatic hammers; specifications are also given.

Stock List. Indian Tool and Supply Co., Inc., Indianapolis, Ind. A revised list of stock on hand including drills, files, taps and dies, hacksaw blades, grinding wheels and cutters. All information necessary for prospective buyers is given in detail.

International Glue Heater. Indian Tool and Supply Co., Indianapolis, Ind. A brief 3½ x 6-in. circular describing the improved electric glue heater now offered on the market by this company. It is said that the heater is clean, safe, economical and free from fire risk. Detailed specifications of sizes and operation are included.

Precision and Thread Grinder Manufacturing Co., Philadelphia, Pa., announces that additional loose leaf catalog pages are now ready for distribution. These new pages cover the operations of internal thread grinding, and grinding spindle threads on new and used lathes.

Essentials of Trading with Latin America. Guaranty Trust Co., New York, N. Y. Booklet 5 x 7 in., thirty pages, giving a brief but thorough digest on trade conditions with our Southern neighbors. Some of the subjects covered include, markets, payments, exchange, packing, shipping, weights and markings of packages, import restrictions, trade marks, insurance and credits.

Olympia Exhibition. Alfred Herbert, Ltd., Coventry, England. A profusely illustrated catalog giving many views, inside and outside, of the great Herbert shops at Coventry.

Scientific Facts. The Champion Rivet Co., Cleveland, Ohio. (Alex. S. Mitchell, selling agent, 95 Liberty St., New York City.) A well-bound and made-up volume of 150 pages, containing valuable information about "Victor" boiler, structural and ship rivets and many tables giving approximate weight of various types of rivets for certain kinds of work. About fifty pages of the book are devoted to halftone illustrations of boilers, tanks, cars, ships, bridges, buildings and other structural work, in which these rivets have been used. Several letters of endorsement, and also the results of some severe tests of champion rivets, are included.

The Melting Pot. The Chicago Flexible Shaft Co., 5601 Roosevelt Rd., Chicago, Ill., is issuing this booklet each month. Each number contains a good deal of useful information on the subject of heat-treatment and relative matters.

"Meno" Rust Remover. Peter A. Frasse & Co., Inc., 417-421 Canal St., New York. Folder, 3½ x 6½ in. This folder describes the use of "Meno" rust remover, preventive and cleanser, for cleaning machines, engines, tools, parts and all metal surfaces.

Advertising Prospectus, No. 2. Black & Decker Manufacturing Co., Baltimore, Md. A beautifully made up and illustrated catalog, thirty 11 x 14-in. pages. "Do you believe in advertising?" is the caption of the preface to this unusual discourse on the value of advertising. The book is replete with samples of Black & Decker ads, showing the various schemes to attract attention to the product.

Quartz Lamp and Ultra-Violet Light and Quartz Lamp Laboratory Outfit. Cooper-Hewitt Electric Co., Hoboken, N. J. Bulletins Nos. 102 and 86. Bulletin No. 102, by L. J. Buttolph, of the Engineering Department, illustrates and describes briefly its quartz lamp and ultra-violet light, while Bulletin No. 86 gives instructions in the operation of its quartz lamp laboratory outfit.

Catalogs Wanted

Consul Charles H. Albrecht writes from ..eval, Esthonia, that he is anxious to receive, for use in connection with the extension of American trade, catalogs and price lists of American firms interested in export trade.

Forthcoming Meetings

The Society of Automotive Engineers will hold its annual meeting on Jan. 11 to 13 inclusive at New York.

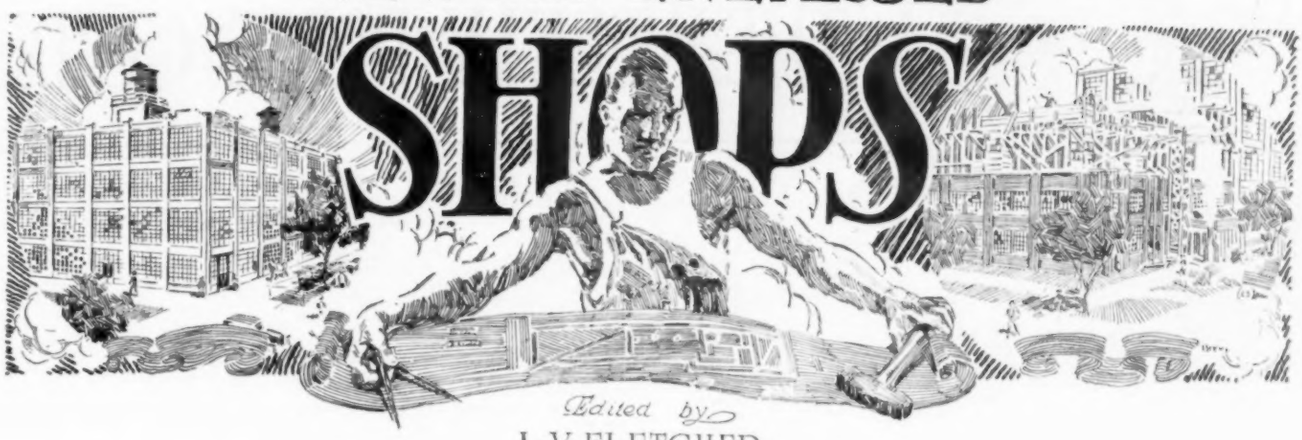
A conference of State Manufacturers' Associations, will be held at the Congress Hotel, Chicago, on Jan. 12. Manufacturers, merchants, railway executives and shippers will attend this meeting to protest against the formation of a national board of adjustment said to be demanded by the railroad brotherhoods. The address of the State Manufacturers' Ass'n is 104 South Michigan Ave., Chicago.

The Engineering Institute of Canada will hold its thirty-fifth annual meeting in Toronto, King Edward Hotel, on Feb. 1, 2 and 3.

A triple convention of the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association will be held in Atlantic City, N. J., May 16, 17 and 18, 1921, with headquarters for all three associations at the Marlborough-Blenheim. F. D. Mitchell, 4106 Woolworth Building, New York, is secretary of the last-named association.

The Spring Convention of the National Machine-Tool Builders' Association will be held on Thursday and Friday, May 19 and 20, at Hotel Traymore, Atlantic City, N. J. Chas. E. Hildreth, care of the Association Worcester, Mass., is general manager.

NEW *and* ENLARGED



Edited by
L·V·FLETCHER

Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Pa., Philadelphia—The Amer. Eng. Co., Wheatsheaf Lane and Speviva St.—foundry equipment.

Pa., Columbia—The Myers Machine Tool Corp.—planers, shapers, etc.

Va., Richmond—F. Baptist Auto Painting & Repair Shop, 2100 West Broad St., F. Baptist, Purch. Agt.—machinery outfit.

Ill., Chicago—The Inland Rubber Co., La Salle and 27th Sts.—1 used punch and shear to take ½ x 3 in. stock.

Ind., Anglo — The Swenson Evaporator Co.—tools and equipment.

O., Bucyrus—The Ohio Locomotive Crane Co.—general equipment.

O., Cleveland—The Northern Blower Co., West 65th St. south of Dennison Ave.—one 10 ft. power roll ⅝ in. capacity, one 10 ft. shear ⅜ in capacity and one punch press.

O., Cleveland—The Weber Co., Woodland and 55th Sts.—hand screw machine.

Wis., Milwaukee—The Baraboo Mfg. Co., 657 28th St., manufacturer of refrigerating machinery, G. Bauer, Purch. Agt.—1 tool room lathe, 1 miller, 1 shaper and 1 power saw.

Wis., Milwaukee—The Meehan Mfg. Co., 709 M. & M. Bank Bldg., W. Richter, Purch. Agt.—gang punch press for material up to 42 in.

Wis., Milwaukee — The Reliable Auto Signal Co., 120 Wisconsin St., C. Yockey, organizer—machine tools for the manufacture of auto accessories.

Wis., Chippewa Falls—H. Powers, Grand Ave. and Bay St.—garage repair machinery.

Kan., Garden City — The Osborn Automatic Damper Co., E. A. Orr, Mgr.—equipment for making metal stamping and general machine shop work (new or used).

Machinery Wanted

N. J., Jersey City—R. Griffin Co., 151 West Side Ave.—one roller mill for grinding inks.

Ga., Camp Benning (Columbus P. O.)—The Constructing Quartermaster, Headquarters Bldg.—equipment for refrigeration plant.

Ga., Columbus—J. W. and G. Woodruff—equipment for their sand and gravel plant.

O., Columbus—The Burns Coal Co., 1120 West Tower St., L. Burns, Purch. Agt.—complete coal handling machinery.

O., Columbus—The Continental Clay Co., Columbus Savings & Trust Bldg., D. M. Swicher, Genl. Mgr.—complete coal handling machinery for its yard at 332 Gallaway Ave.

Wis., Bayfield—C. O. Bigler—3 can sealing machines and 3 peeling machines for cannery (power operated).

Wis., Green Bay—The Amer. Auto Body Co., Howard and Pearle Sts., J. T. Perry, Purch. Agt.—machinery for the manufacture of wood and metal bodies

Wis., Fairwater — The Fairwater Hemp Co., T. L. Miller, Purch. Agt.—hemp making machinery.

Wis., Fond du Lac—The Latex Tire & Rubber Co., East Scott St.—rubber-working machinery.

Wis., Hartford—Denison & Coerper—coal crane.

Wis., Independence—M. H. Zimmers and B. V. Schneider—universal planer and sawing outfit for wood-working plant.

Wis., Jefferson — The Jefferson Rubber Co., c/o C. R. Girton, Mgr.—one large and one small traveling crane for moulds.

Wis., Rice Lake—H. Ashlin, Reuter Ave.—wood-working machinery including a large planer.

Tex., College Station—The Texas A. E. M. College, A. Bizzell, Pres.—machinery for its proposed mechanical engineering laboratory building.

Tex., Waco—The International Co., 510 Franklin St.—3 spindle machine for drilling holes in oak battery boxes.

Cal., Los Angeles — The Santa Fe R.R. Co., Kerchoff Bldg.—ice-making machinery and conveyors.

Metal Working

NEW ENGLAND STATES

Conn., Bridgeport — J. Lipsitz, 83 Fairfield Ave., will build a 1 story, 60 x 90 ft. addition to his garage on State St. Estimated cost, $10,000.

Conn., Waterbury—Smith & Griggs Co., South Main St., has awarded the contract for the construction of a 1 story, 25 x 65 ft. garage on South Main St. Estimated cost, $10,000.

Mass., East Boston (Boston P. O.)—P. Rich, 67 Byron St., will build a 1 story, 60 x 100 ft. garage on Frenton St. Estimated cost, between $25,000 and $30,000.

Mass., New Bedford — J. Chicoine, 28 Larch St., will build a 1 story, 85 x 100 ft. garage on Larch St. Estimated cost, between $15,000 and $20,000.

Mass., South Boston (Boston P. O.)—Sampson & Coleman, 10 Hawley Pl., Boston, have awarded the contract for the construction of a 1 story, 35 x 115 ft. garage on East 1st St. Estimated cost, $25,000. Noted Dec. 9.

Mass., Worcester—D. Shapiro, 295 Southbridge St., will build a 1 story garage on Harding St. Estimated cost, $30,000. Noted Aug. 19.

Mass., Worcester — Sleeper & Hartley Inc., 335 Chandler St., is having plans prepared for the construction of a 1 story, 60 x 200 ft. factory for the manufacture of wire. Estimated cost, $50,000. Private plans. Noted Dec. 9.

N. H., Berlin—Dept. of Pub. Wks. plans to build a 1 story, 20 x 60 ft. garage and blacksmith shop. Estimated cost, $15,000. F. J. Brennan, c/o owner, Engr.

MIDDLE ATLANTIC STATES

N. Y., New York (Borough of Bronx)—Jeffrey Bros., 106 Sherman Ave., will alter their 2 story garage. Estimated cost, $30,000.

N. Y., New York (Borough of Brooklyn)—J. T. Aaron, 936 St. Marks Ave., will build a 1 story, 230 x 245 ft. garage on Pacific St. near Schenectady Ave.

N. Y., New York (Borough of Brooklyn)—S. Ageloff, 126 Reid Ave., will build a 1 story, 75 x 100 ft. garage on Seigel St. near Bushwick Ave. Estimated cost, $25,000.

N. Y., New York (Borough of Brooklyn)—S. Ageloff, 126 Reid Ave., will build a 1 story, 100 x 200 ft. garage on Myrtle Ave. near Lewis Ave. Estimated cost, $100,000.

N. Y., New York (Borough of Brooklyn)—F. Aliano, 245 44th St., will build a 1 story addition to his hardware factory on 44th St. near 3d Ave. Estimated cost, $35,000.

N. Y., New York (Borough of Brooklyn)—The W. Ulmer Brewery Co., 3 Belvidere St., will build a 1 story, 100 x 195 ft. garage on Myrtle Ave. near Bway. Estimated cost, $75,000.

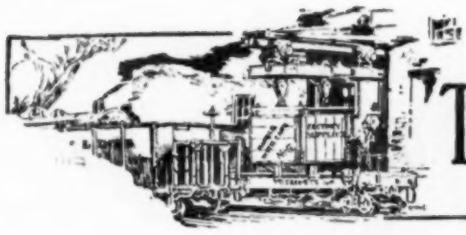
N. Y., New York (Borough of Brooklyn)—S. A. Werthein, c/o C. L. Sefert, Archt. and Eng., 206 West 76th St., New York City, will build a 1 story, 100 x 175 ft. garage on Grand St. near Morgan St., here. Estimated cost, $70,000.

N. Y., New York (Borough of Manhattan)—A. C. Chesley & Co., 277 Rider Ave., will build a 50 x 200 ft. factory on 132d St., for the manufacture of metal doors. Noted Oct. 14.

N. Y., New York (Borough of Manhattan)—J. Guarino, c/o D. Bleier, Archt. and Engr., 2366 Webster Ave., will build a 1 story, 80 x 100 ft. garage at 28-32 Hamilton St. Estimated cost, $75,000.

Pa., Johnstown — The Flood City Mfg. Co., Elder St., plans to build a 2 story, 80 x 200 ft. plant for the manufacture of gray iron, malleable castings, mine cars, etc. Estimated cost, $250,000. J. L. Hershberger, Pres.

Pa., Philadelphia—The Amer. Eng. Co., Wheatsheaf Lane and Speviva St., plans to rebuild its 1 story foundry which was recently destroyed by fire. Estimated cost, $20,000. Private plans.



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

	Current	One Year Ago
CINCINNATI		
No. 2 Southern	$44.50	$30.35
Northern Basic	40.00	27.55
Southern Ohio No. 2	42.00	28.55
NEW YORK—TIDEWATER DELIVERY		
2X Virginia (Silicon 2.25 to 2.75)	51.26	32.40
Southern No. 2 (Silicon 2.25 to 2.75)	48.26	35.20
BIRMINGHAM		
No. 2 Foundry	40.50	29.25
PHILADELPHIA		
Eastern Pa., No. 2x, 2.25-2.75 sil.	42.50	29.00-30.00
Virginia No. 2	46.25	33.10
Basic	38.25	26.75
Grey Forge	40.25	26.75
CHICAGO		
No. 2 Foundry local	40.00	26.75
No. 2 Foundry, Southern	46.66	28.00
PITTSBURGH, INCLUDING FREIGHT CHARGE FROM VALLEY		
No. 2 Foundry	41.96	28.15
Basic	38.00	27.15
Bessemer	38.00	29.35

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Current	New York One Month Ago	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Year Ago
Structural shapes	$3.80	$4.15	$3.47	$3.58	$3.37	$3.58	$3.47
Soft steel bars	3.70	4.15	3.37	3.34	3.27	3.48	3.37
Soft steel bar shapes	3.70	4.15	3.37	3.48	3.27	3.48	3.37
Soft steel bands	4.65	5.50	4.07	6.25	.....	.....	.....
Plates, ¼ to 1 in. thick	4.00	4.15	3.67	3.78	3.57	3.78	3.67

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, Pittsburgh	$4.25	$2.77
Warehouse, New York	4.75	3.37
Warehouse, Cleveland	3.52	3.27
Warehouse, Chicago	4.12	3.37

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	New York Current	New York One Year Ago	Cleveland	Chicago
No. 10	3.55	5.20	4.57	5.00	6.13
No. 12	3.60	5.25	4.62	5.05	6.18
No. 14	3.65	5.30	4.67	5.10	6.23
No. 16	3.75	5.40	4.77	5.20	6.33
Black					
Nos. 18 and 20	4.20	6.30	5.30	5.60	6.90
Nos. 22 and 24	4.25	6.35	5.35	5.75	6.95
No. 26	4.30	6.40	5.40	5.80	7.00
No. 28	4.35	6.50	5.50	5.90	7.10
Galvanized					
No. 10	4.70	7.05	5.75	6.25	7.25
No. 12	4.80	7.15	5.85	6.35	7.30
No. 14	4.80	7.15	5.85	6.35	7.45
Nos. 18 and 20	5.10	7.40	6.15	6.65	7.75
Nos. 22 and 24	5.25	7.55	6.30	6.80	8.15
No. 26	5.40	7.70	6.45	6.95	8.30
No. 28	5.70	8.00	6.75	7.25	8.60

Acute scarcity in sheets, particularly black, galvanized and No. 16 blue enameled. Automobile sheets are unavailable except in fugitive instances, when prices are 9.45c per lb. for No. 16; 9.50 for Nos. 18 and 20, and 9.55c for Nos. 22 and 24.

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$5.50	$5.80	$4.84
Flats, square and hexagons, per 100 lb. base	6.00	6.30	5.34

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent.
New York	50
Cleveland	50
Chicago	50

NICKEL AND MONEL METAL—Base prices in cents per pound F.O.B. Bayonne, N. J.

Nickel	
Ingot and shot	43
Electrolytic	45

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55
Special Nickel and Alloys			
Malleable nickel ingots			45
Malleable nickel sheet bars			47
Hot rolled rods, Grades "A" and "C" (base)			60
Cold drawn rods, grades "A" and "C" (base)			72
Copper nickel ingots			42
Hot rolled copper nickel rods (base)			52
Manganese nickel hot rolled (base) rods "D"—low manganese			64
Manganese nickel hot rolled (base) rods "D"—high manganese			67

Domestic Welding Material (Swedish Analysis)—Welding wire in 100-lb lots sells as follows, f. o. b. New York: ⅜", 8½c. per lb.; ¼, 8c.; ⅜ to ½, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	7.00	8.00	9.00
Spring steel (light)	10.00	7.00	12.00
Coppered bessemer rods	9.00	8.00	6.75
Hoop steel	4.70	4.04	5.32
Cold-rolled strip steel	9.50	8.25	10.75
Floor plates	6.25	4.00	6.63

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

BUTT WELD

Inches	Steel Black	Steel Galvanized	Inches	Iron Black	Iron Galvanized
¼ to 3	54–57½%	41½–44%	¼	15½–25½%	+1½–11½%
			⅜	19½–29½%	1½–11½%
			½ to 1¼	24½–34½%	8–18½%

LAP WELD

2	47–50½%	34½–38%	1¼	.....	.....
2½ to 6	50–53½%	37½–41%	1½	.....	.....
7 to 12	47–50½%	33½–37%	2	20½–28½%	6½–14½%
13 to 14	37½–41%	.....	2½ to 6	22½–30½%	9½–17½%
15	35–38½%	.....	7 to 12	19½–27½%	6½–14½%

BUTT WELD, EXTRA STRONG PLAIN ENDS

¼ to 1¼	52–55½%	39½–43%	¼ to 1½	24½–34½%	9½–19½%
2 to 3	53–56½%	40½–44%			

LAP WELD, EXTRA STRONG PLAIN ENDS

2	45–48½%	33½–37%	1¼	.....	.....
2½ to 4	48–51½%	36½–40%	1½	.....	.....
4½ to 6	47–50½%	35½–39%	2	21½–29½%	8½–16½%
7 to 8	43–46½%	29½–33%	2½ to 4	23½–31½%	11½–19½%
9 to 12	38–41½%	24½–28%	4½ to 6	22½–30½%	10½–18½%
			7 to 8	14½–22½%	2½–10½%
			9 to 12	9½–17½%	5½+2½%

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
¼ to 3 in. steel butt welded	38%	22%	39%	30%	54%@40%	40½@30 %
2½ to 6 in. steel lap welded	33%	18%	41%	26%	50@40%	37½@27½%

Malleable fittings. Classes B and C, banded, from New York stock sell at plus 45%. Cast iron, standard sizes, plus 5%.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

	Current	Month Ago	Year Ago
Copper, electrolytic	15.00	15.00	22.50
Tin in 5-ton lots	35.25	36.75	56.50
Lead	5.75	5.75	6.25
Zinc	7.00	7.00	7.60
ST. LOUIS			
Lead	6.25	7.25	6.00
Zinc	6.75	6.25	7.15

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

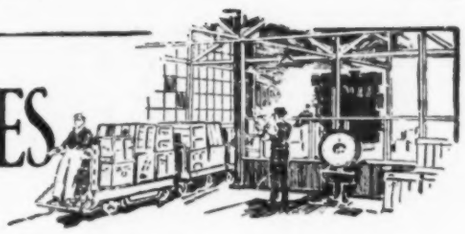
	New York Current	New York Month Ago	New York Year Ago	Cleveland Current	Cleveland Year Ago	Chicago Current	Chicago Year Ago
Copper sheets, base	22.50	22.50	33.50	24.50	35.50	28.50	36.50
Copper wire (carload lots)	17.00	20.00	30.75	22.00	30.50	25.00	26.00
Brass sheets	20.25	22.25	32.00	25.00	33.00	25.25	28.00
Brass pipe	25.00	25.00	36.00	27.00	39.00	30.00	37.00
Solder (half and half) (case lots)	27.75	27.25	45.00	29.00	41.00	22.50	38.50

Copper sheets quoted above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill, 1000 lb. and over, warehouse; net extra:

	Current	One Year Ago
Mill	18.25	24.00
New York	18.25	28.00@29.75
Cleveland	23.00	29.00
Chicago	23.25	27.00

SHOP MATERIALS AND SUPPLIES



ZINC SHEETS—The following prices in cents per pound are f.o.b. mill — less 8% for carload lots..... 11.50

	Warehouse			
	—In Casks—		— Broken Lots —	
	Current	One Year Ago	Current	One Year Ago
Cleveland	15.30	12.50	14.70	13.00
New York	14.00	11.50	14.50	12.50
Chicago	14.50	16.50	14.95	16.00

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	6.25	9.50
Chicago	7.00	9.75
Cleveland	7.50	9.75

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	*New York			
	Current	One Year Ago	Cleveland	Chicago
Copper, heavy, and crucible	12.00	17.00	10.00	11.50
Copper, heavy, and wire	11.50	16.00	9.50	11.00
Copper, light, and bottoms	10.00	14.00	9.00	9.50
Lead, heavy	4.00	4.75	4.00	4.50
Lead, tea	3.00	3.75	3.00	3.50
Brass, heavy	7.00	10.50	7.00	10.50
Brass, light	5.50	7.50	5.00	5.50
No. 1 yellow brass turnings	6.50	10.00	5.50	5.50
Zinc	4.50	5.00	3.00	4.50

*These prices nominal because of dull market

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb.	$33.00	$26.00	$33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	28.00	32.00
Chicago	21.00	31.00
Cleveland	25.00	35.00

BABBITT METAL—Warehouse price per pound:

	—New York—		—Cleveland—		—Chicago—	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	70.00	90.00	44.00	70.00	43.00	60.00
Commercial	30.00	50.00	16.50	16.50	11.00	13.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York we quote the best two grades, although lower grades may be obtained at from $16 to $20.

SHOP SUPPLIES

NUTS—From warehouse at the places named, [illegible]r-sized orders, the following amount is deducted from list:

	— New York —		— Cleveland —		— Chicago —	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	+$1.25	$1.50	List net	$2.25	+1.15	1.85
Hot pressed hexagon	+ 1.25	1.50	List net	2.25	+1.15	1.85
Cold punched hexagon	+ 1.25	1.50	List net	2.25	+1.15	1.30
Cold punched square	+ 1.25	1.50	List net	2.25	+1.15	1.30

Semi-finished nuts, ⅝ and smaller, sell at the following discounts from list price:

	Current	One Year Ago
New York	30%	50–10%
Chicago	40%	50%
Cleveland	50%	55%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	+10%	5%	20%
Larger and longer up to 1¼ in. by 30 in.	Net list	4%	10%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers.

New York..... list Cleveland..... $2.75 Chicago..... $1.90

For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:

New York..... $7.00 Cleveland..... $4.50 Chicago..... $5.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	+20%	40%	20%
Larger and longer up to 1 in. by 30 in.	+20%	35%	15%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	25%	20%	10%	10%
Chicago	net	20%	net	20%
New York	30%	40%	net	20%

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	20%	50%	30%
Tinned	20%	50%	30%

Boiler, ½, ⅝, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:

New York..... $6.00 Chicago..... $5.73 Pittsburgh..... $4.60

Structural, same sizes:

New York..... $5.73 Chicago..... $5.83 Pittsburgh..... $4.50

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	$26.00	30.00	31.00
Brass	25.00	27.00	30.00

The prices, of course, vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1 c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities from 10-25 lb., extra is 10c.; less than 10 lb., add 15-20c.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ½-2 in. inclusive in rounds, and ½-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $1.50.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $8.85 per 100 lbs.

In Cleveland—$10 per 100 lbs.

COTTON WASTE—The following prices are in cents per pound:

	New York			
	Current	One Year Ago	Cleveland	Chicago
White	13.00@15.00	13.00	15.00	15.00@17.00
Colored mixed	7.00@12.00	9.00–12.00	11.00	11.00@13.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½x13½	13½x20½
Cleveland	55.00	65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.00	$2.00	$1.75
Philadelphia	2.75	2.75	1.75
Cleveland	3.00	3.00	2.50
Chicago	2.00	2.75	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.50	$3.50	$3.65
Philadelphia	3.65	3.65	3.87
Chicago	3.85	3.85	4.12½

COKE—The following are prices per net ton at ovens, Connellsville:

	December 27	December 20	December 13
Prompt furnace	$7.00@$7.50	$7.00@$7.50	$7.00@$7.50
Prompt foundry	8.50@9.00	8.50@9.00	8.50@9.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	100-lb. bag	1.00

LINSEED OIL—These prices are per gallon:

	—New York—		—Cleveland—		—Chicago—	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw in barrels, (5 bbl. lots)	$0.90	$2.15	$1.05	$2.50	$1.01	$2.37
5-gal cans	1.05	2.30	1.30	2.75	1.26	2.57
1-gal cans (6 to case)	1.15	.....	.....	.....	.....	.....

WHITE AND RED LEAD—Base price per pound:

	Red				White	
	Current		One Year Ago		Current	One Year Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100 lb. keg	14.00	15.50	13.00	14.50	14.00	13.00
25 and 50-lb. kegs	14.25	15.75	13.25	14.75	14.25	13.25
12½-lb. keg	14.50	16.00	13.50	15.00	14.50	13.50
5-lb. cans	17.00	18.50	15.00	16.50	17.00	15.00
1-lb. cans	19.00	20.50	16.00	17.50	19.00	16.00

500 lb. lots less 10% discount. 2,000 lb. lots less 10–4% discount. 10,000 lb. lots less 10–7½% discount.

Pa., Pittsburgh — H. Lohrey Co., 2236 East St., will soon award the contract for the construction of a 3 story, 25 x 95 ft. auto truck repair shop on East and Howard Sts. Estimated cost, between $20,000 and $25,000. C. W. Hodgdon, Martin Bldg., Archt.

SOUTHERN STATES

W. Va., Morgantown—Fire recently destroyed the machine shop of C. Jackson and A. Grow, on Long St.

MIDDLE WEST STATES

Ill., East St. Louis—The East St. Louis Locomotive & Car Co., c/o R. W. Crawford, Engr., 5483 Ellis Ave., Chicago, has purchased a site here and plans to build a car and locomotive repair plant to include a wooden freight car repair shop, a shop for rebuilding steel underframes for wooden cars, an all-steel car repair shop and a locomotive repair shop, etc. Estimated cost, $1,000,000.

O., Cincinnati—The Herold Motor Car Co., 920 Race St., plans to build an 87 x 95 ft. service station at 214 Webster St. Estimated cost, $60,000.

O., Cincinnati—J. H. McGowan, 916 4th Natl. Bank Bldg., manufacturer of pumps, plans to build an addition to his factory on 2nd St. and Center Ave. Estimated cost, $190,000. Tretig & Lee, 901 4th Natl. Bank Bldg., Archts.

O., Cleveland—The Excelsior Auto Supply Co., 1812 Euclid Ave., has awarded the contract for the construction of a 1 story, 40 x 35 ft. garage. Estimated cost, $25,000.

O., Cleveland — The Cretney Co., 14453 Euclid Ave., plans to build a 1 story, 70 x 130 ft. garage on Euclid and Eastham Aves. Estimated cost, $50,000. T. A. Cretney, Pres.

O., Cleveland—The Mall Motor Co., 652 Superior Ave., has awarded the contract for the construction of a 2 story, 130 x 160 ft. garage on Superior Ave. and East 12th St. Estimated cost, $200,000.

O., Cleveland—The Par Brook Mfg. Co., Brookpark Rd., manufacturer of metal products, plans to build a 1 story, 60 x 150 ft. addition to its factory. Estimated cost, $50,000. G. S. Rider & Co., Century Bldg., Archts.

Wis., Kaukauna — The Kaukauna Motor Service Co., c/o J. Hennes, will build a 2 story, 50 x 100 ft. garage and show room on 3d and Main Sts. Estimated cost, $75,000. Noted Nov. 25.

Wis., Ladysmith—R. J. Clark, Coloma, plans to build a 1 story, 60 x 100 ft. garage on Main St., here. Estimated cost, $20,000. Private plans.

Wis., Manitowoc—The Manitowoc Shipbuilding Co., 16th St. and River will soon award the contract for the construction of a 1 story, 60 x 180 ft. round house, etc. on 8th St. Estimated cost, $75,000. Private plans.

Wis., Menomonie—W. Link plans to build a 1 story, 50 x 90 ft. garage. Estimated cost, $15,000.

Wis., Okauchee—W. Schradenbach plans to build a 1 story, 50 x 80 ft. garage. Estimated cost, $18,000.

Wis., Valders—W. F. Christel will soon award the contract for the construction of a 2 story, 34 x 150 ft. garage on Main St. Estimated cost, $75,000. Juul-Smith, Imig Bldg., Sheboygan, Archts. Noted Dec. 16.

WEST OF THE MISSISSIPPI

Kan., Garden City — The Osborn Automatic Damper Co., Pueblo, Col., plans to construct a factory, here, for the manufacture of metal stampings, etc.

WESTERN STATES

Cal., Los Angeles — N. Meyer, c/o Los Angeles Soap Co., 633 East 1st St., has awarded the contract for the construction of a 1 story, 53 x 176 ft. garage on Washington and Union Aves. Estimated cost, $15,000. A. G. Faulker Co., lessee.

CANADA

Ont., Toronto—The city will build a 1 story, 80 x 100 ft. garage on Dundas St. Estimated cost, $50,000.

Ont., Toronto — G. A. Morgan, 875 St. Clair Ave., has awarded the contract for the construction of a 2 story, 60 x 80 ft. garage on St. Clair Ave. Estimated cost, $50,000.

Ont., Windsor — The Universal Garage Co., 116 Chatham St. W., has awarded the contract for the construction of a 2 story, 90 x 115 ft. garage and sales building on Chatham St. Estimated cost, $70,000.

General Manufacturing

NEW ENGLAND STATES

R. I., Pawtucket — The Hope Webbing Co., 1005 Main St., has awarded the contract for the construction of a 5 story, 80 x 190 ft. addition to its factory, etc., on Main St. Estimated cost, $300,000.

R. I., Pawtucket — Lecht Bros., 599 Dexeter St., plan to rebuild their slaughter house, on Concord St. Private plans.

R. I., Woonsocket—The Lafayette Worsted Co., Hamlet St., will soon award the contract for the construction of a 4 story, 138 x 246 ft. addition to its plant for combing and spinning departments. Estimated cost, $350,000. W. F. Fontaine, Federal Bldg., Archt.

MIDDLE ATLANTIC STATES

Md., Rockville — The International Shoe Heel Corp. is having plans prepared for the construction of four 1 story, 35 x 200 ft. heel shops and two 4 story, 45 x 200 ft. shoe shops. Estimated cost, $350,000. H. C. Cutler, Mutual Fire Bldg., 13th and H Sts., Washington, D. C., Archt. and Engr.

N. J., Millville — The Whithall Tatum Co., 46 Barclay St., New York City, is having plans prepared for the construction of a 2 story, 35 x 105 ft. factory, here, for the manufacture of glass ware. R. W. Pollock, 1802 Chestnut St., Philadelphia, Pa., Archt.

SOUTHERN STATES

Ga., Camp Benning (Columbus P. O.)—The Constructing Quartermaster, Headquarters Bldg., will soon award the contract for the construction of a refrigeration plant. Estimated cost, $25,000.

N. C., Lexington—The Grimes Ice Cream Co. plans to build a plant. J. C. Grimes, Mgr.

Ga., Cartersville — The Ladd Lime & Stone Co. plans to install a 2nd unit, so as to double the capacity of its plant.

Ga., Columbus—J. W. and G. Woodruph plan to enlarge their sand and gravel plant. Estimated cost, $30,000.

S. D., Sioux Falls—The Natl. Concrete Materials Co., Luverne, Minn., plans to build an office building, here, and a sand, gravel and concrete tile plant, just outside of the city limits. Estimated cost, $125,000. R. W. Miller, Secy.

Tenn., Chattanooga—The Dubois Rubber and Tube Co. plans to construct the first unit of its plant.

Va., Emporia — The Emporia Potassium Phosphate Co. plans to build a fertilizer plant. Carneal & Johnston, Chamber of Commerce Bldg., Richmond, Archts.

MIDDLE WEST STATES

Ill., Chicago — The Amer. Envelope Co., 817 West Washington Blvd., is having plans prepared for the construction of a 1 story, 170 x 350 ft. factory. Estimated cost, $50,000. P. V. Hyland, 29 South La Salle St., Archt.

Ind., Scottsburg — The Morgan Canning Co., Austin, plans to build a 1 story, 60 x 150 ft. canning factory, here. Estimated cost, $20,000. Private plans.

O., Cleveland — The Acme Petroleum Products Co., 3591 West 56th St., plans to build a 2 story factory. Estimated cost, $75,000. Private plans.

Mich., Ann Arbor — The University of Michigan, c/o M. L. Burton, Pres., plans to build engineering shops and laboratories. Estimated cost, $1,500,000.

Wis., Berlin—W. C. Russell Moccasin Co., c/o W. C. Russell, Pres., has had plans prepared for the construction of a 3 story, 40 x 130 ft. factory on Main St. Estimated cost, $75,000. Private plans.

Wis., Fond du Lac—The Latex Tire & Rubber Co., East Scott St., will build a 2 story, 60 x 80 ft. addition to its factory. Estimated cost, $35,000.

Wis., Jefferson — A. Heilemann & Co. plans to build a 3 story, 70 x 112 ft. ice cream factory on Main St. Estimated cost, $75,000.

Wis., Milwaukee—The Panay Horizontal Show Jar Co., 1102 32d St., will open bids about Jan. 1 for the construction of a 2 story, 120 x 125 ft. factory for the manufacture of glass display jars. A. R. Koch, Wells Bldg., Archt.

Wis., Rice Lake—H. Ashlin, Reutor Ave., plans to build a 3 story, 66 x 150 ft. factory for the manufacture of church, store and office fixtures and furniture. Estimated cost, $75,000.

WEST OF THE MISSISSIPPI

Ark., Springdale—The Welch Grape Juice Co., Portage St., Westfield, N. Y., plans to build a factory, here. Estimated cost, $375,000. J. F. Welch, Vice-Pres.

Minn., St. Paul—The Farmers Consolidated Distributing Co., 935 Andrus Bldg., Minneapolis, plans to build a 3 story, 75 x 125 ft. factory on Prior Ave. and Montague Pl., for the manufacture of powdered buttermilk. Estimated cost, $350,000.

Mo., St. Louis — I. Oldani, 1823 South Kingshighway will build a 1 and 2 story, 59 x 72 ft. food products factory. Estimated cost, $7,000.

Tex., College Station—The Texas A. E. M. College plans to reconstruct its mechanical engineering laboratory building which was recently destroyed by fire. Loss of building $25,000, machinery $50,000. A. Bizzell, Pres.

WESTERN STATES

Cal., Burbank—The Linoleum & Window Shade Co. is having plans prepared for the construction of 3 buildings on Vine St. and San Fernando Rd., to include a 42 x 201 ft. main building, 25 x 25 ft. warehouse and a 20 x 30 ft. office building. Cost to exceed $50,000. Private plans.

Cal., Los Angeles—The Santa Fe R.R. Co., Kerckhoff Bldg., is having plans prepared for the construction of a 4 story, 85 x 275 ft. ice plant at Hobart Station. W. H. Mohr, 761 Kerckhoff Bldg., Archt.

Cal., Santa Monica—The Santa Monica Ice Co., 12th St. and Colorado Ave., will build a 1 story, 32 x 50 ft. ice plant. Estimated cost, $8,000.

CANADA

Ont., Hamilton — The anadian Libbey Owens Sheet Glass Co. has awarded the contract for the construction of a 150 x 540 ft. sheet glass plant. Estimated cost, $1,000,000.

Ont., London—The Canadian Vitex Feed & Mil'ing Co., Toronto, plans to build a feed mill, here. Estimated cost, $75,000. W. A. Green, Dominion Savings Bldg., Mgr.

Que., Limoilou—The Canada Box & Lumber Co., Bergmont Ave., will receive bids about Jan. 1 for the reconstruction of its plant. Estimated cost, $100,000.

Que., Montreal—The Salada Tea Co., 155 Berkeley St., Boston, Mass., has purchased a 10 story, 65 x 85 ft. office and plant building on St. Laurence Blvd. and plans to remodel and equip same for its own use. Estimated cost, $150,000. Denamore & De Clear, 88 Broad St., Boston, Mass., Archts. and Engrs.

Que., Montreal—M. B. Steine, Ltd., plan to enlarge its plant on Grey Nuns St., for the manufacture of boots and shoes. Estimated cost, $100,000.

Vol. 53, No. 27 December 30, 1920 *25 cents a copy*

American Machinist

KENNETH H. CONDIT and FRED H. COLVIN, *Editors*
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McGRAW-HILL COMPANY, INC., Tenth Ave. at 36th St., NEW YORK

Publishers also of Electrical World—Electrical Merchandising—Power—Engineering News-Record—Engineering and Mining Journal Chemical and Metallurgical Engineering—Electric Railway Journal—Coal Age—Journal of Electricity—Ingeniería Internacional

Annual subscription rate, $5. Extra zone postage west of the Mississippi, and in Alaska, Hawaii, the Philippines, Porto Rico, Canal Zone, Cuba and Mexico, $1. Extra postage in Canada, $1.50. Extra postage on American Edition in foreign countries, except Europe and British possessions in Eastern Hemisphere $4 (total, $9 or 38 shillings). McGraw-Hill Publishing Co., Ltd., 6 Bouverie St., London, E.C. 4, England, will serve with the European Edition only all subscribers in Europe and British possessions in Eastern Hemisphere (40 shillings for England and 45 shillings elsewhere in Eastern Hemisphere.)

WASHINGTON, D.C., 610-11 Colorado Bldg.
CHICAGO, 1570 Old Colony Building
PHILADELPHIA, Real Estate Trust Bldg.
CLEVELAND, Leader-News Building
SAN FRANCISCO, Rialto Building
LONDON, E. C., 6 Bouverie St.
BUENOS AIRES, Calle Corrientes, 685.

Cable Address: "Machinist, N. Y."

Change of Address—When change of address is ordered the new and the old address must be given. Notice must be received at least ten days before the change takes place.

Copyright, 1920, McGraw-Hill Company, Inc.

Published weekly.
Entered as second-class matter, June 23, 1879, at the Post Office at New York, under the Act of March 3, 1879.
Member Associated Business Papers, Inc.
Member Audit Bureau of Circulations

CIRCULATION OF THIS ISSUE 25,623
(Includes European Edition).

The Slaughter of the Innocents

WHEN JESUS CHRIST came upon the earth, nearly two thousand years ago, to save all mankind, his mere coming seemed to interfere with the material interests of a few people of that period, notably King Herod, who promptly decided to dispose of this "interloper," and sent forth his soldiers with orders to slay all the children of two years old and under. Thus was consummated the most atrocious crime against innocent childhood ever committed up to that time. It has come down to us through all the ages in song and story, and master painters have pictured it on marvelous canvases.

To-day passing in review, as we look out through the windows of our comfortable homes in this great and happy land, are three and a half millions of helpless children, the innocent victims of the greatest war that has ever afflicted humanity. It matters not, as we gaze in the direction of these children, that our eyes must stretch across three thousand miles of ocean, we still can see them and we still can hear them, if we wish to do so; and we can not help hearing the tragic appeal in their voices and seeing their tiny arms stretched out to us, and their searching eyes looking into our souls, as they say, "Help us, or we perish." And if we fail to listen to this great call of three and a half millions of God's helpless children; if we close our eyes and ears to this great demand of duty, we will be just as guilty of the "slaughter of the innocents" as was Herod, nearly two thousand years ago.

In these lands, swept by death and filled with tragedies too deep for tears, a sum of human suffering is being written greater perhaps than for all ages gone by. The mind grows numb and the heart sick from a constant recital of tales of such tragedy as it is difficult to believe the twentieth century could hold.

And so, when the call for help came from Mr. Hoover telling that America must not allow hunger and cold to return to this mass of 3,500,000 helpless children the soul of America was stirred and the hot blood surged up in our hearts. It is our imperative duty to use all the power God has given us to aid this noble-hearted American in continuing the work of saving human lives to which he has devoted unsparingly, and at great personal sacrifice, his tremendous energy and administrative genius during the past six years, in which time he and his American colleagues have administered two billions of dollars of relief funds from all parts of the world with a total overhead expense of only three-eighths of one percent., without any remuneration to the American directors. Now he asks us all to help save the children who are in imminent danger of starvation this coming winter.

There they are, in the midst of wrecked homes, and farms, and factories; in cities crowded with masses of refugees without sustaining food for children, through the destruction of live stock; seeds for planting, raw materials, tools, and machinery gone; great areas with everything burned, or looted, or smashed; vast unemployment for workers; no means of subsistence; a land of economic ruin, of mutilated life, and lingering death; and in the midst of it all —the little children.

In long lines they are waiting at the American food-kitchens. Will the food be there for them? Will they be turned away? There are no happy, healthy faces in those long lines—not one. You have seen rags and barefooted children, but never so many little boys and girls literally drest in tatters. They are facing a winter of devastating cold, and for those bare little feet and legs and arms there is nothing at home to put on.

Hollow faces and shrunken bodies are so common that their real conditions does not become evident until we inquire more closely, and then we find that most of them are from one to five years back in their growth. Children of eight years old have not reached the normal size of two and a half. They are just learning to stand alone. Others almost as old can not yet stand on their feet. Their arms, and legs, and spines, and chests are twisted and warped. The flesh and skin are shriveled on their bones. It is surprising that life can still exist there. If they can have food they will gradually regain their health and strength, but with most of them it is a question of now or never. Starvation and tuberculosis will not wait.

In Poland alone a million five hundred thousand such children must be cared for. In Latvia and Esthonia the people are living mostly on a diet made from potato-flour, oat-flour, and sawdust. In Czecho-Slovakia, in Hungary, in Austria, and in other countries of central and southeastern Europe, two millions more are in dire need of food; and who stops to ask regarding creed, or race, or nationality when a little child is starving? Children are just children the world over, and the great American heart is big enough to care for them all.

But the appeal now is not for all. The three and a half millions of children in immediate danger of starvation, if this organization fails, who *must* have food at once, are only a fraction of the total number. The hungry children of those destitute countries have been examined by competent physicians, and only those whose wasted little bodies are reduced to the minimum weight, and whose endurance of hunger has reached the end which merges into actual starvation, are admitted to the American kitchens and given *one meal a day*. It is hard to turn away thousands of hungry boys and girls—to hear them ask, pleadingly, "Do I weigh too much?" "Am I not thin enough?" "Can't I come any more?" But this restricting of food to the extreme cases is compulsory, because there isn't enough for all.

And these neediest ones can not reach the kitchens through the cold winds and the snow barefooted and in the pitiful rags which form only a partial covering for their bodies. They must have clothes. Each outfit consists of one pair of warm woolen stockings, one pair of boots, and a little overcoat. This one meal a day, and these boots, stockings, and little coat can be supplied *only if we give them*. If we do not, the slaughter of the innocents by cold and starvation will be appalling.

Among those who will read this page there is not one—there can not be a single one—whose heart will not respond gladly and eagerly to the challenge of this great need. We are asking *you* to cooperate with Mr. Hoover in raising twenty-three million dollars to feed and clothe these children and save them from death this winter. It can be done. It shall be done! This publication knows its readers and the deep earnestness, the quick sympathy, the great-hearted generosity they always show when any real human need calls to them. You have never been called upon in vain. We are counting on you now with a great confidence. We know, also, how truly you represent the American spirit, which beats in the hearts of over a hundred million people in this big land of plenty, a spirit which leaps ready at every such call, and is never weary in well-doing. We are not a hermit nation, isolated from the world, when suffering and want cry out to us from anywhere under the sun. A great, a beautiful, and heart-sustaining hope supports these stricken people—*America will come to their relief*. For in the far places of the earth, where famine stalks, one name and one alone is synonymous with rescue and hope—and that name is America.

The small individual unit of ten dollars will provide the coat and boots and stockings and one meal a day for one child this winter. We urge our readers—we urge *every one* whose eyes are on these words—to give quickly as many of these units as possible, **to buy for themselves that precious and priceless thing, the live of a little child**—as many of them as they can, and everyone will be a shining star in an eternal crown. It was the Divine Lover of little children, who came to earth as a little child, and who reigns now as the King of Glory, who said, "Inasmuch as ye have done it unto one of the least of these, ye have done it unto me." He does not forget, nor fail to reward.

Mr. Hoover, Chairman of the European Relief Council which has been organized to spread this great need before the American people, is asking twenty-three millions to save the lives of these little innocent children who are facing death. This European Relief Council includes among its workers the following organizations—American Friends' Service Committee (Quakers), American Relief Administration, Jewish Joint Distribution Committee, American Red Cross, Knights of Columbus, Federal Council of Churches of Christ in America, Y. M. C. A. and the Y. W. C. A. These organizations, led by Mr. Hoover, are banded together in this great cause for humanity to redeem the little lives and save the terrible toll of tiny graves by the hundred thousand.

Let us all see again what the Father's heart is like in this great rich land of America. Let us spring to the rescue, as true Americans always have done, and contribute to the extent of our hearts—for never was a need more urgent or help wanted more quickly.

Make your check payable to Franklin K. Lane, Treasurer, and mail it to the European Relief Council, 42 Broadway, New York City. Every dollar will go toward the purpose for which you give it without one penny deducted. Give, and give *now*.

Combines the Advantages of Slotter and Horizontal Shaper

In addition to being more accurate than the slotter or horizontal shaper, the Pratt & Whitney Vertical Shaper can handle a very much larger variety of work.

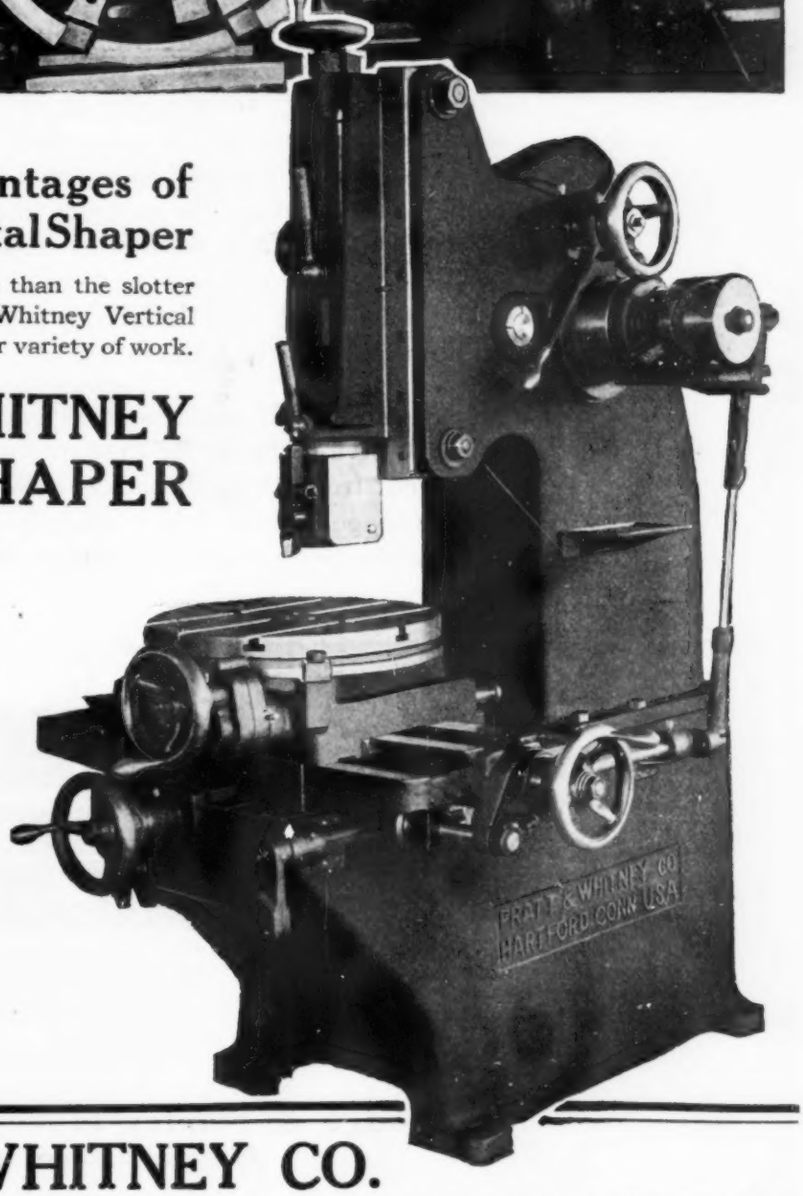
PRATT & WHITNEY VERTICAL SHAPER

Ram can be swung to any angle up to 5 degrees which is an absolute necessity in many operations. This distinctive feature has proved very advantageous in machining dies as the desired draft can be readily obtained.

Rotary feed permits machining of concave and convex surfaces. Irregular work as well as hexagonal and octagonal surfaces are also readily handled.

Tool head can be swiveled through a complete circle. This enables the operator to set the tool at the most advantageous position permitting the planing of two or even four sides of certain work at one setting.

Other novel features and details as to interesting applications are described in our catalogue.



PRATT & WHITNEY CO.

General Offices: 111 Broadway, New York **Works: Hartford, Connecticut**

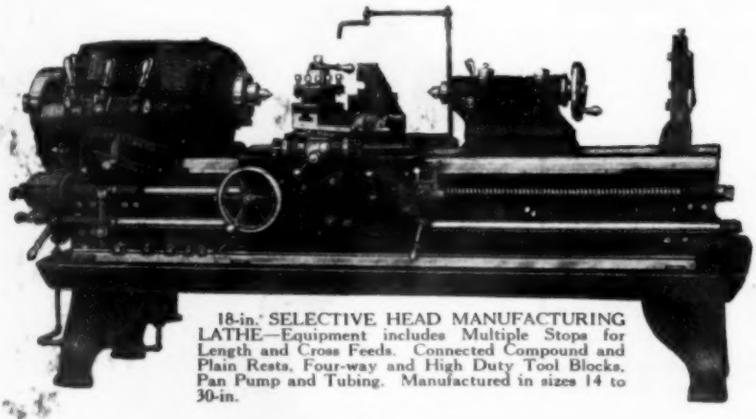
LODGE & SHIPLEY

28TH YEAR

In beginning our twenty-eighth year of business we extend to our many friends the Season's Greetings and hope that the coming year will further our pleasant relations.

It is fitting at this time to announce that we have always devoted our energies exclusively to the manufacture of lathes. In specializing on lathes we have been able to concentrate on one product with the result that it has been developed to a very high degree. The simplicity of operation, the accuracy and the timesaving features of the LODGE & SHIPLEY lathes have linked themselves solidly together and throughout the world the name LODGE & SHIPLEY is associated with the best obtainable in the lathe market.

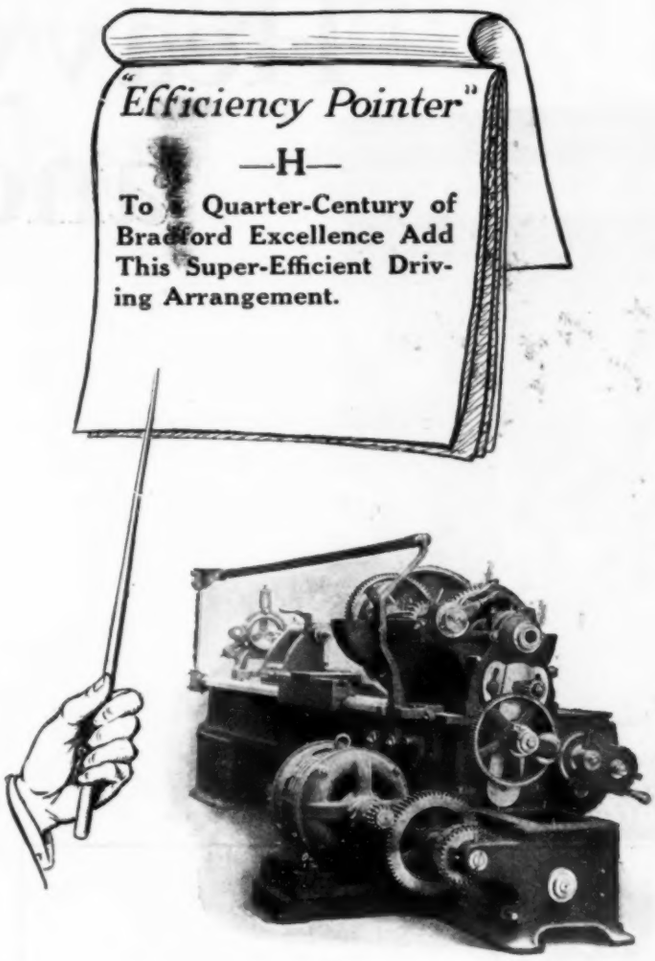
The cut shows an 18 in. Selective Head Manufacturing Lathe. With this lathe the time on duplicate pieces of work is cut from 25 to 50 per cent. We have an interesting 16 page bulletin which explains all about it. It will be a pleasure to send it. Ask for Bulletin No. 186.



18-in. SELECTIVE HEAD MANUFACTURING LATHE—Equipment includes Multiple Stops for Length and Cross Feeds. Connected Compound and Plain Rests, Four-way and High Duty Tool Blocks, Pan Pump and Tubing. Manufactured in sizes 14 to 30-in.

The Lodge & Shipley Machine Tool Co.
Cincinnati, Ohio

The A-B-C of Modern Lathe Efficiency



WHEN the Bradford Single Pulley or Motor Driven Lathe was brought out, the purpose was to combine Geared Head power and convenience with Bradford's famous precision and high quality of performance. This called for wide departures from ordinary geared-head design, with its inevitable vibration, noise and chatter.

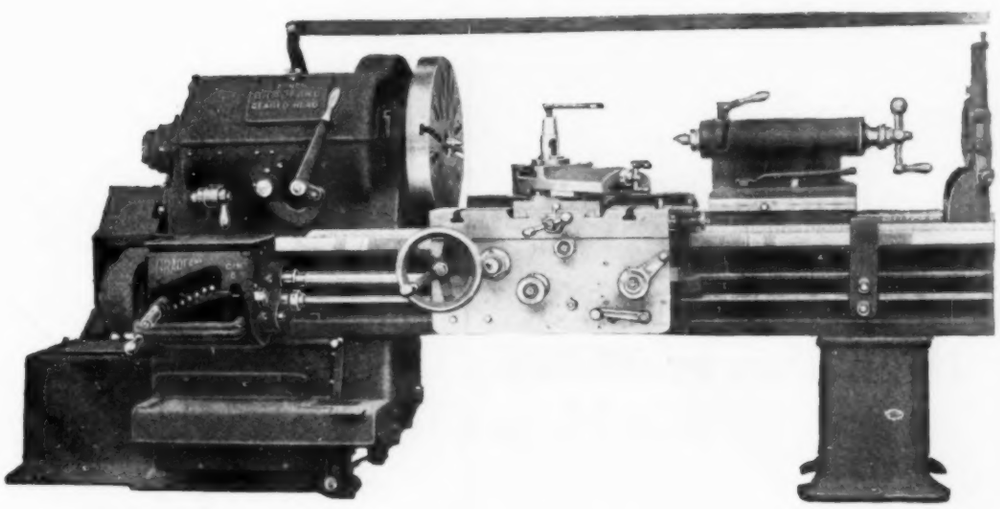
Note the distinctive advantages Bradford engineers have embodied in the low drive, slow-running shock-absorbing gears, and handy control. The motor is placed where it cannot produce vibration—in the base instead of on the head. The "down pull" of the chain drive counteracts the upward lift of the tool, and *binds the head to the bed.* And by mounting the selective driving gears in the leg, space in the head is left for massive gears that eliminate the "back-lash" common with a multiplicity of small gears, shafts and clutches.

The convenient shifter pole frees the operator's right-hand for calipering, etc., and is so arranged that gears cannot be engaged until driving power is disengaged. Motor or pulley drive interchangeable.

Greater output is possible on the Bradford, whether the work be "hogging" out heavy jobs on a production basis, or light precision tool room assignments. And best of all, the Bradford stays accurate through years of severe usage.

The complete story is well worth reading. You and your operators will enjoy Bulletin 25. Send for it today.

The Bradford Machine Tool Company
Cincinnati, Ohio, U. S. A.

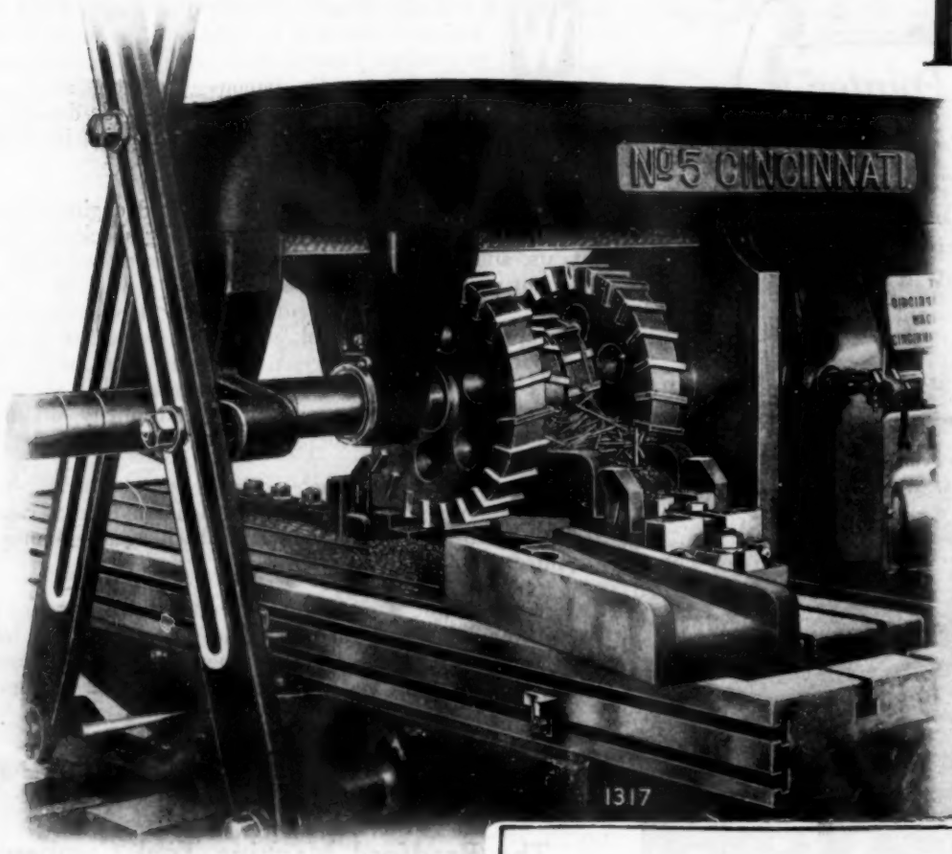


DOMESTIC AGENTS: Swind Machinery Co., Philadelphia, Pa.; Taylor Machinery Co. Boston, Mass.; Somers, Fitler & Todd Co., Pittsburgh, Pa.; The Stocker-Rumely-Wachs Co., Chicago, Ill.; Pacific Tool & Supply Co., San Francisco, Cal.; The E. A. Kinsey Company, Cincinnati, Ohio, Indianapolis, Ind.; W. J. Baird Machinery Co., Detroit, Mich.; Ogden R. Adams, Rochester, N. Y.; Ralph B. Bowman, St. Louis, Mo.; The Biggs-Watterson Co., Cleveland; McMullen Machinery Co., Grand Rapids, Mich.; Patterson, Gottfried & Hunter, Inc., New York City.

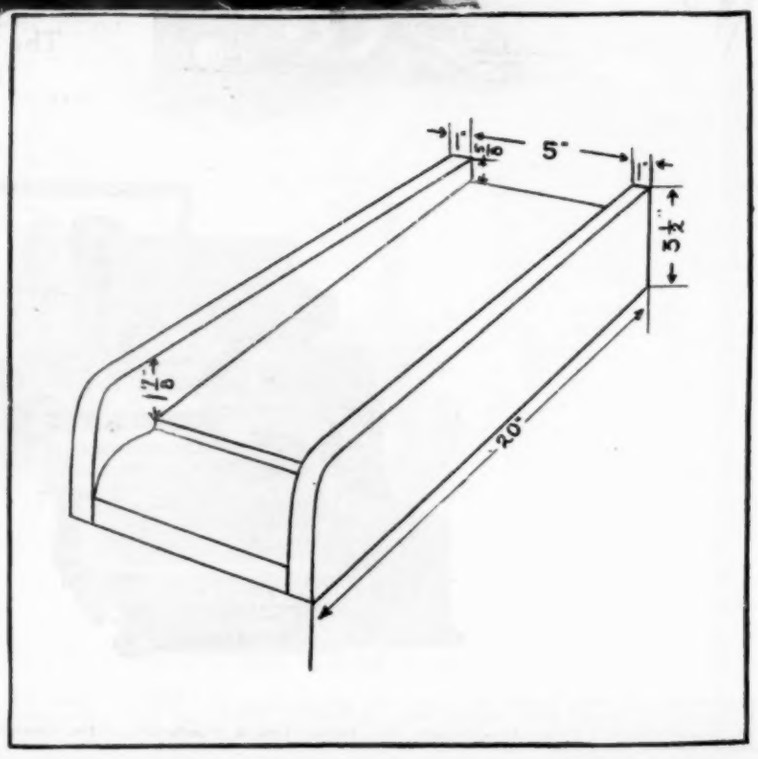
Bradford Lathes are LATHES OF QUALITY and are FULLY GUARANTEED.

Domestic Agents: Henry Prentiss and Co., Inc., New York, Boston, Hartford, Buffalo, Syracuse, Rochester, Scranton; The Motch & Merryweather Mchy. Co., Cleveland, Detroit, Pittsburgh, Cincinnati; Marshall & Huschart Mchy. Co., Chicago; W. E. Shipley Mchy. Co., Philadelphia; Elliott & Stephens Mchy. Co., St. Louis, Kansas City; Marshall & Huschart Mchy. Co. of Indiana, Indianapolis; Kemp Mchy. Co., Baltimore.

Heavy and



8 minutes per piece on the Cincinnati No. 5 High Power Miller



Canadian Agents: H. W. Petrie, Ltd., Toronto, Hamilton; H. W. Petrie, Ltd., of Montreal, Montreal; General Supply Co. of Canada, Winnipeg. **Foreign Agents:** Chas. Churchill & Co., Ltd., London, Birmingham, Manchester, Newcastle-on-Tyne, Glasgow; Aux de Vulcain, Paris, Lyons, Bordeaux; E. Isbecque & Co., Brussels, Antwerp; Chr. A. Herstad, Copenhagen, Stockholm; Gustav Nielsen A/S, Christiania; Hijo de Miguel Mateu, Barcelona, Lisbon;

Salt Lake Hardware Co., Salt Lake City; Robinson, Cary & Sands Co., St. Paul, Duluth; Harron, Rickard & McCone, San Francisco, Los Angeles; Hallidie Mchy. Co., Seattle, Vancouver; Hendrie & Bolthoff Mfg. & Supply Co., Denver; Zimmerman-Wells-Brown Co., Portland; Dewstoe Machine Tool Co., Birmingham; Seeger Machine Tool Co., Atlanta; C. T. Patterson Co., Ltd., New Orleans.

work, high production the No. 5 Cincinnati—

The illustration shows the Cincinnati No. 5 High Power Miller with equipment designed by our Service Department at work on locomotive shoes and wedges. They are gray iron castings, and the milling cut removes from 3/16 to 5/16-in. metal over the entire surface. The total width of cut is 13¾-in. The large chip, clearly shown, results from the depth of cut and the rate of feed, which is 11¼-in. per minute.

The cutters and the fixtures were designed by our Service Department. They enable our No. 5 High Power Miller to produce shoes and wedges in from 7½ to 8 minutes per piece—approximately one-third the usual planing time.

Besides great power and the necessary rigidity to use it, there are a number of exclusive features about this machine well worthy of your investigation. Some of them are:

Intermittent feed, dog controlled.

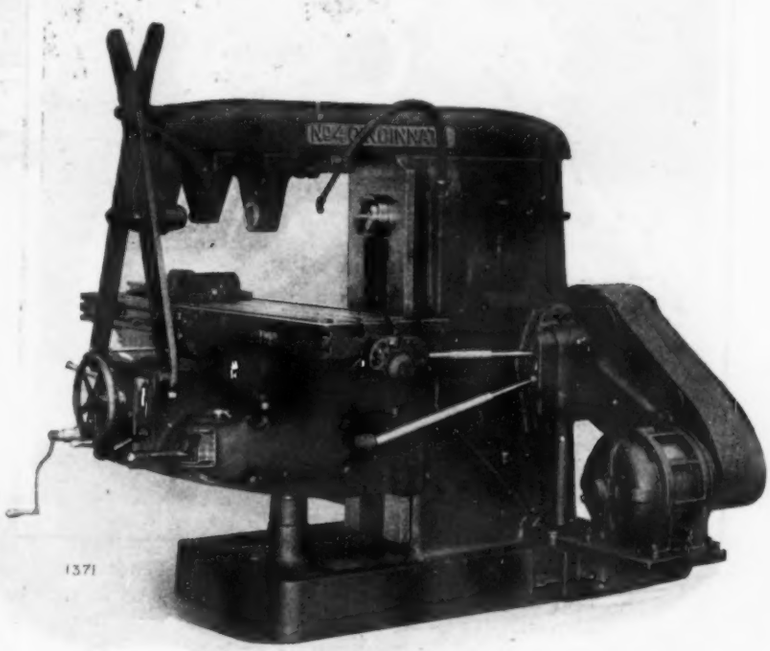
A single lever for all feed changes.

Feed changes made at front of knee.

Rectangular overarm.

Square Gibbed Bearings with narrow Guides.

We invite you to put your Milling problems up to us. Send us blueprints and let us show how to cut your milling costs.



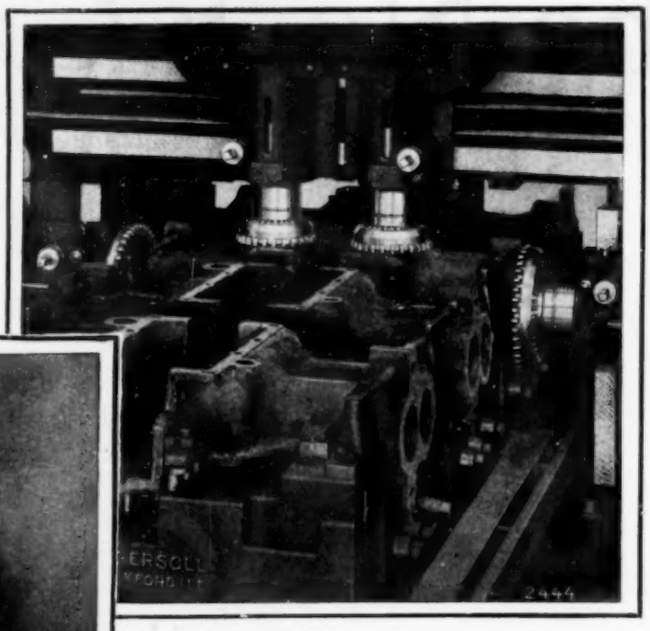
The Cincinnati Milling Machine Co.
Cincinnati, Ohio

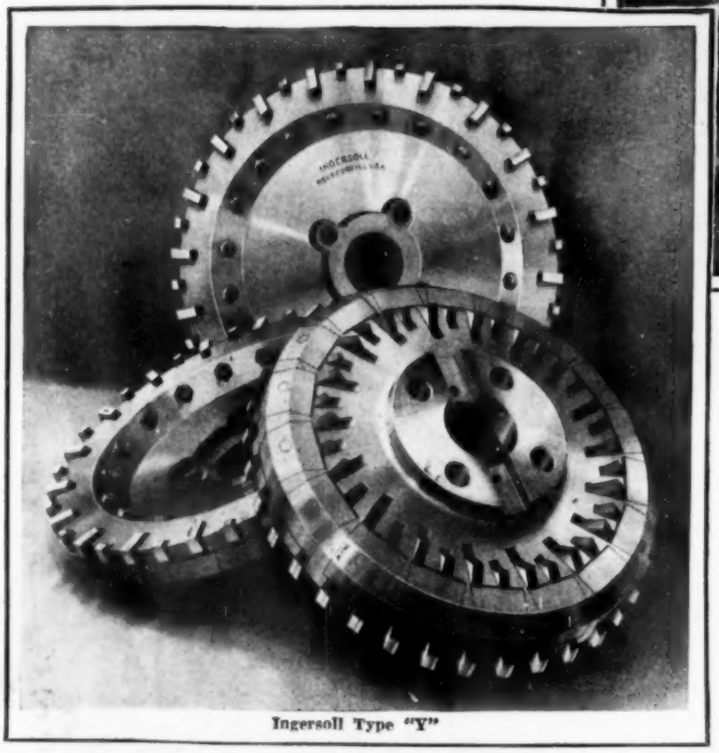
J. Lambercier & Co., Geneva, Zurich; Ercole Vaghi, Milan; Maskin-Aktiebolaget E. Gronblom, Abo, Helsingfors; Andrews & George Co., Tokyo, Usaka & Yokohama; McPhersons Pty., Ltd., Melbourne, Sydney; D. Drury & Co., Johannesburg; Negroni Hermanos, Buenos Aires.

Ingersoll
Inserted Tooth Milling Cutters

No. 2

On high production milling in cast iron work where depth of cut is not excessive we recommend the Ingersoll Type "Y" Face Milling Cutter.





Ingersoll Type "Y"

This cutter in addition to being a general purpose cutter is especially adapted to milling frail castings where the cut is broken up into narrow sections. The illustration above shows these cutters face milling gray iron castings. This is a case where the machine, fixtures, and cutters were designed by us. The customer told us to produce results and we did.

The Type "Y" is only one of the Standard Ingersoll Cutters that have been carefully developed during many years of experience in the design and manufacture of Heavy Milling Machines and their equipment.

Standard Ingersoll Cutters are carried in stock at Rockford.

Write today for our cutter catalog No. 38.

THE INGERSOLL MILLING MACHINE COMPANY

Milling Machines and Their Equipment

Main Office and Works: Rockford, Illinois, U. S. A.

New York—50 Church St.; Detroit—1457 David Whitney Bldg.; London—Burton, Griffiths & Co., Ltd.; Paris—Fenwick Freres & Co.; Japan—Andrews & George.

HEAVY BETTS DUTY

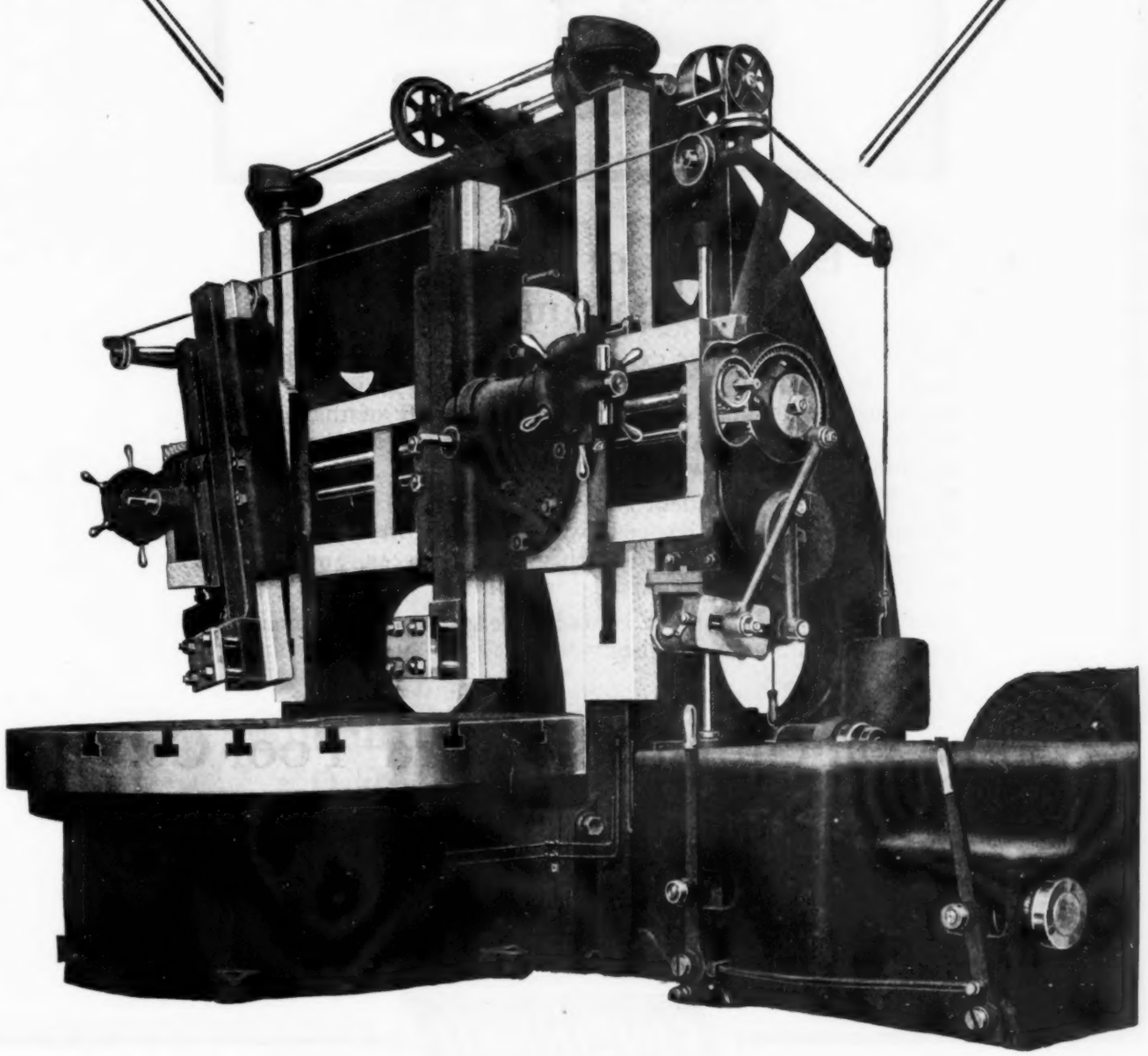
Get the Right Tire Turning Machine This Year

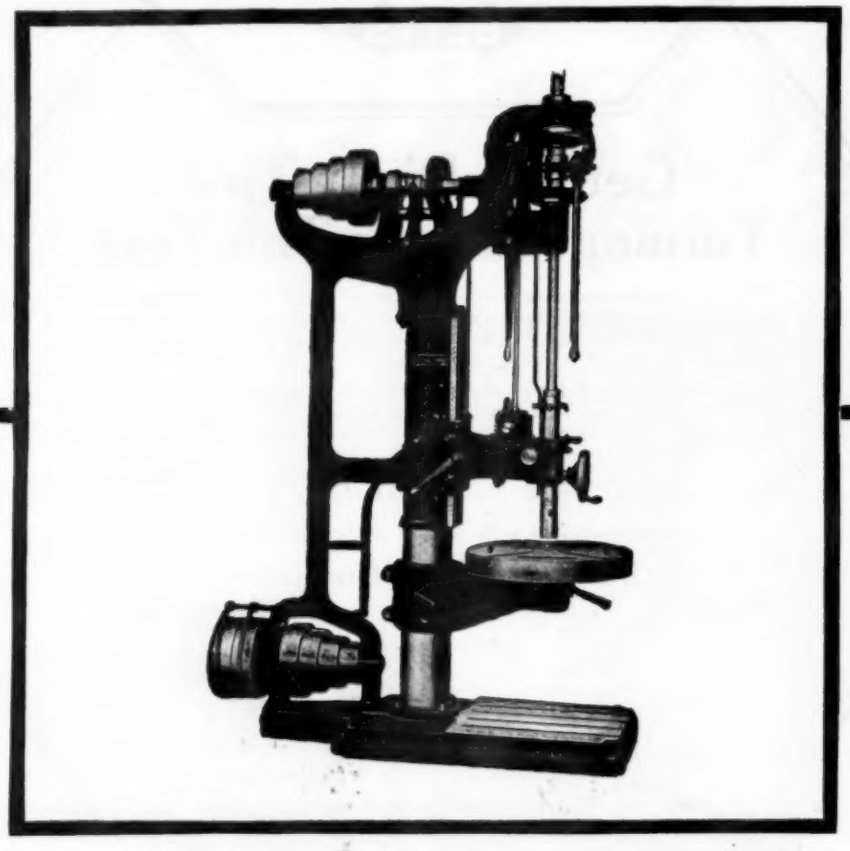
This is a good time to go into the matter. Betts Tire Turning and Boring Mills are made in both the fixed rail and movable rail types. The movable rail type is shown here. It is an ideal machine for rough turning and finishing steel tires.

The table is mounted on a long spindle of large diameter, and has a wide bearing on the bed. The bed, uprights and crossrail are of heavy box form. Heads are equipped with graduated swivels and are made right and left for close work. Feeds are of intermittent type and may be changed instantly from maximum to minimum without stopping the machine. Driving and feeding gears are all steel.

For more complete information write for Bulletin 1046.

Betts Machine Company
Rochester, N. Y. 402 Blossom Road





Economy of the Tapping Attachment

Besides eliminating the expense and inaccuracy of tapping by hand, the Tapping Attachment effects a great saving in taps by reducing the breakage, and prolonging the life of their cutting edges. It also provides a convenient means for starting and stopping the spindle when changing tools.

The Tapping Attachment acts through friction clutches and is hence operative at all speeds without shock or noise. It has unusual gripping power, is adjustable for wear, and may be disengaged when not required for tapping.

The drill shown at the left is made in eight styles and five sizes, ranging from 24 to 42 inches.

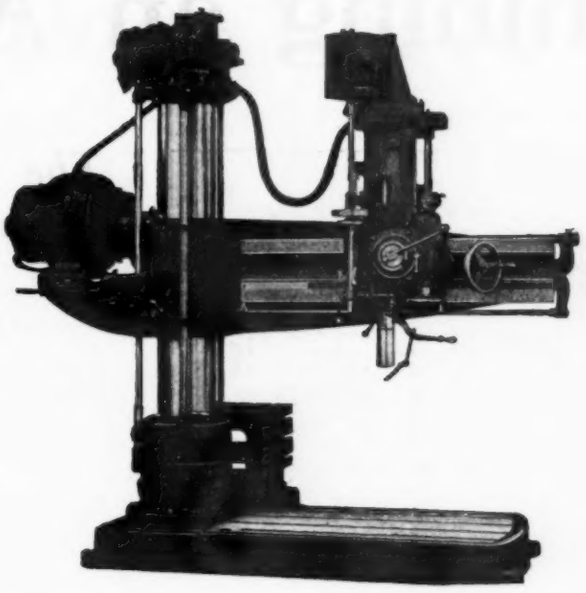
The Cincinnati Bickford Tool Co.

Oakley, Cincinnati, Ohio, U. S. A.

Founded 1874

DOMESTIC AGENTS: Henry Prentiss & Co., Inc., New York; Hartford, Conn.; Boston, Mass.; Buffalo, Rochester and Syracuse, N. Y. **Motch & Merryweather Machinery Co.,** Cleveland, Ohio; Detroit, Mich.; Cincinnati, Ohio, and Columbus, Ohio. **Marshall & Huschart Machinery Co.,** Chicago, Ill. **Brown & Zortman Machinery Co.,** Pittsburgh, Pa. **W. E. Shipley Machinery Co.,** Philadelphia, Pa. **Marshall & Huschart Machinery Co. of Indiana,** Indianapolis, Ind. **Elliott & Stephens Machinery Co.,** St. Louis, Mo. **Harron, Rickard & McCone,** San Francisco, Calif., and Los Angeles, Calif. **C. T. Patterson Co., Ltd.,** New Orleans, La. **Robinson, Cary & Sands Co.,** St. Paul, Minn., and Duluth, Minn. **Kemp Machinery Co.,** Baltimore, Md. **Dewstoe Machine Tool Co.,** Birmingham, Ala. **Seeger Machine Tool Co.,** Atlanta, Ga. **Hallidie Machinery Co.,** Seattle, Wash. **Zimmerman-Wells-**

THE CINCINNATI



A Type of Drive That Many Prefer

There is a good deal to be said for this method of drive—mounting the motor on the arm.

It eliminates four shafts and seven gears thereby obtaining direct power transmission to the spindle. This makes for simplicity, smooth operation and power economy.

The motor at the top of the column renders the elevating mechanism entirely independent of the drive.

These radials are all that an experience of 46 years can make them—thoroughly up-to-date in design and reliable to the last degree in construction.

Let them improve your radial drill output in quality and economy. Our Radial Drill Circulars will be sent on request.

The Cincinnati Bickford Tool Co.

Oakley, Cincinnati, Ohio, U. S. A.

Founded 1874

Brown Co., Portland, Ore. **Charlotte Supply Co.**, Charlotte, N. C. **Cochran Machine Tool Co.**, Memphis, Tenn. **Salt Lake Hardware Co.**, Salt Lake City, Utah. **CANADIAN AGENTS: H. W. Petrie, Ltd.**, Toronto, Ont. **Williams & Wilson, Ltd.**, Montreal and Quebec. **FOREIGN AGENTS: Charles Churchill & Co., Ltd.**, London, Manchester, Birmingham, Newcastle-on-Tyne, England, and Glasgow, Scotland. **Aux Forges de Vulcain**, Paris, France. **Hijo de Miguel Mateu**, Barcelona, Spain. **Ing. Ercole Vaghi**, Milan, Italy. **Ateliers Demoor St. Ame**, Brussels, Belgium. **Chr. A Herstad**, Copenhagen, Denmark and Stockholm, Sweden. **Andrews & George Co.**, Tokyo, Japan. **McPherson's Pty., Ltd.**, Melbourne, Australia. **Bartle & Co.**, Johannesburg, South Africa. **H. S. Gray Co.**, Honolulu, Hawaii. **Gustav Nielsen**, Christiania, Norway. **Maskin-Aktiebolaget E. Gronblom**, Abo, Finland.

THE CINCINNATI BICKFORD

Machining an Accurate

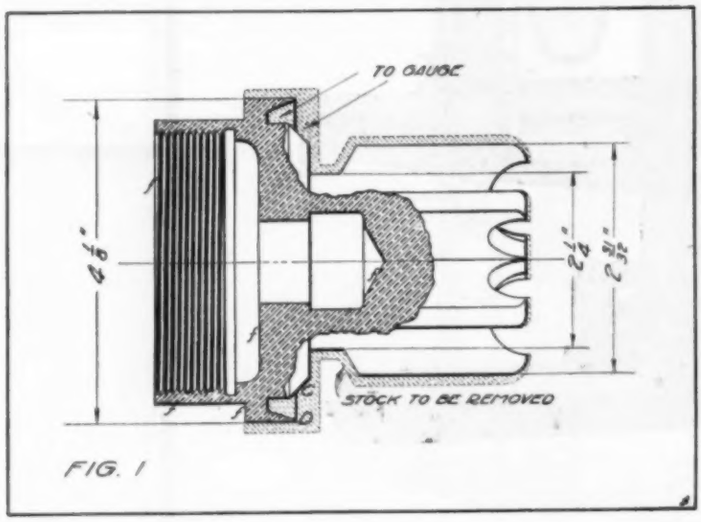


FIG. 1

The Work— Second Operation

A Wing Valve of tough bronze in which the surfaces marked "F" have been finished in the turret lathe as described on this page last week. The metal shown on the double shaded area is to be removed in this operation. Seat *C* must bear a definite relation with edge *D*.

The partly finished valve is screwed onto a threaded plug *a*, being centered in hardened sleeve *b*. This seats it firmly against the face of *b*, and assures that this second operation will be true with the first.

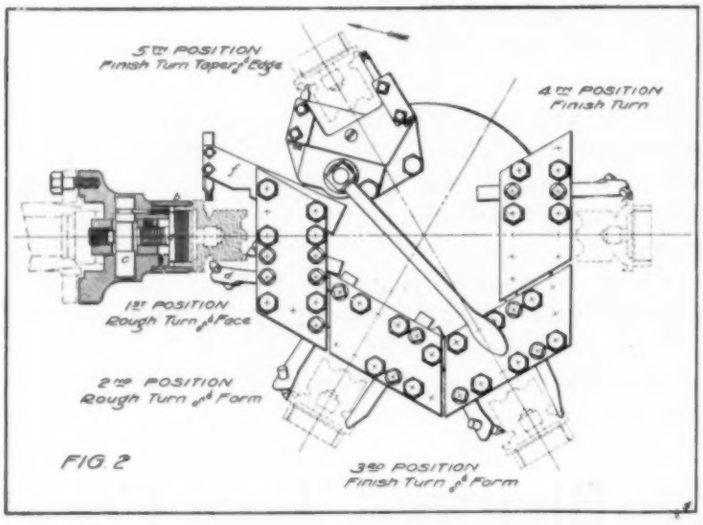


FIG 2

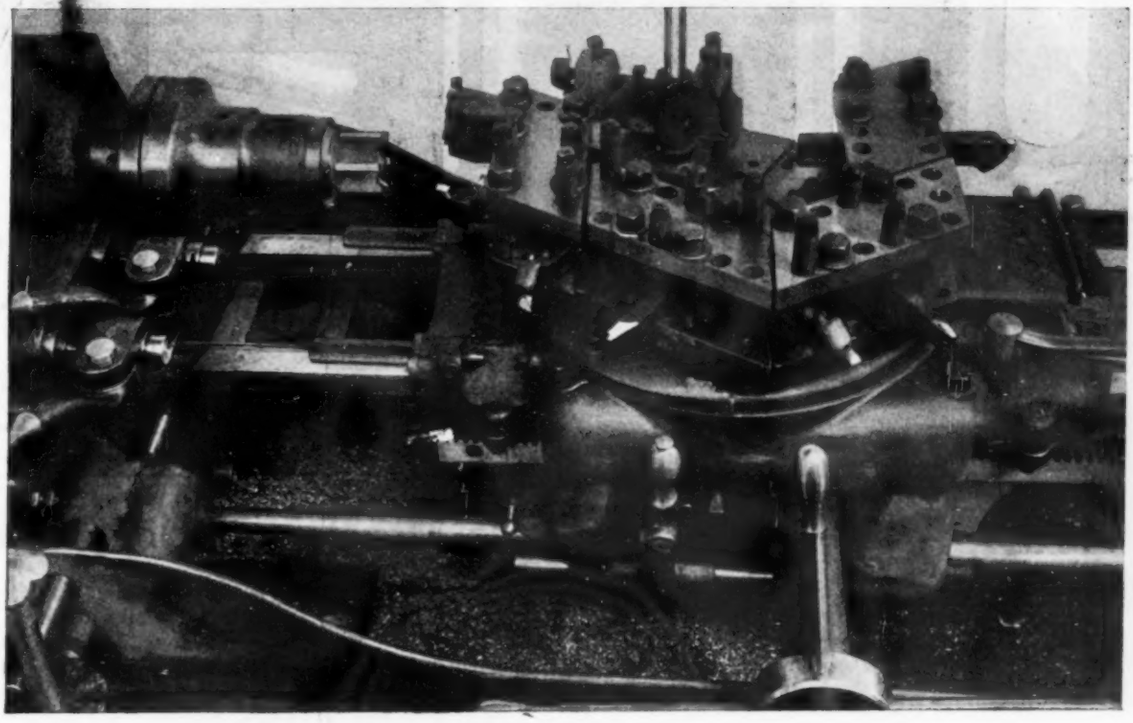
In the first position the turret first feeds tool *d* to turn the wings. The cross feed is then thrown in, and the other two tools face the end and square down the flange.

In the fifth position an angular slide feeds in the direction of the arrow, finishing the seat and trimming the feather edge to the definite relation required The time for this operation is + minutes per piece.

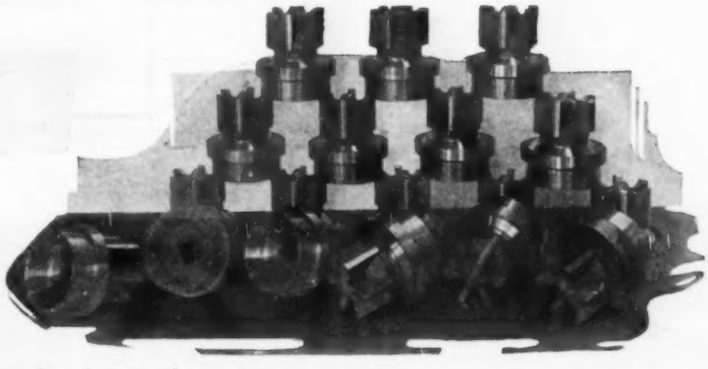
JONES & LAMSON
SPRINGFIELD,

503 Market St., San Francisco, Cal.
9-10 Water Lane, Queen Victoria St., London, England

Bronze Pop Valve (No. 2)



The Machine and Equipment



This work is done in a Hartness Flat Turret (2¼-in. x 24-in. size) with little special equipment.

The work-holding fixture is special to grip on the thread and finished surfaces as described. Chuck jaws would distort this thin shell, even if they were true enough. Eccentric *C* is turned to release the work if tightened on the thread by the intermittent cut.

The whole tool outfit is standard, with the exceptions of holder *F* in position 1 and the cross slide in position 5. The latter is a standard slide, but set on a special angle base, and provided with a special tool holder.

The ability of the Hartness Flat Turret Lathe to do special work at high speed with a minimum of special tooling, is one of its prime advantages.

MACHINE COMPANY

VERMONT, U. S. A.

France, Spain and Belgium: F. Auberty & Co., 91 Rue de Maubeuge, Paris.

Holland: Spliethoff, Beeuwkes & Company, Leuvehaven Wz. 159, Rotterdam. Japan, Korea, etc.: Mitsui & Company, Ltd., Tokyo. Australasia: McPherson's Pty. Ltd., 554 Collins Street, Melbourne. A. Bol Oscar Lindbom, Postbox 420, Stockholm, Sweden.

AMER

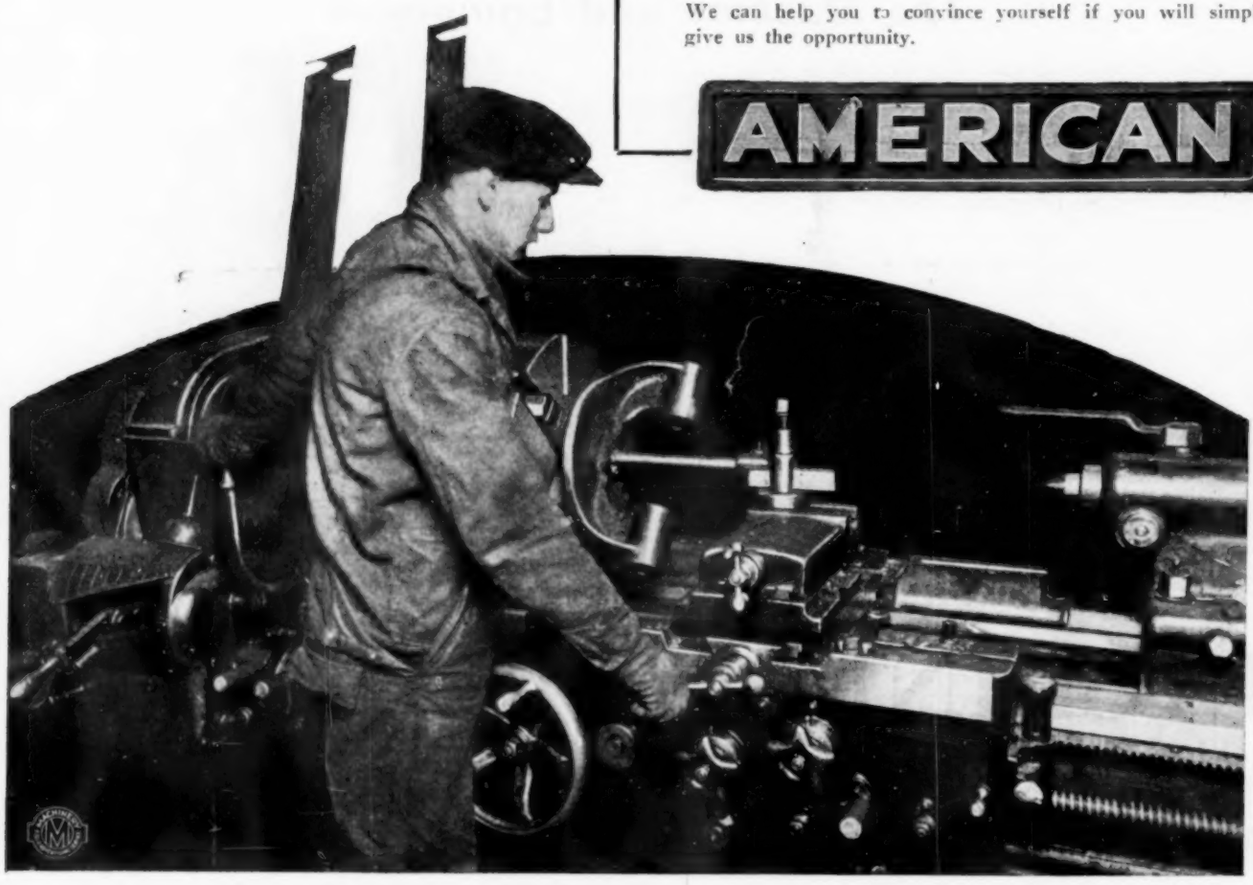
High
Lat

"Do More—and Do It Faster"

A large user of "American" Lathes tells the whole story in six short words. He can "do more" work "and do it faster" on "American" Lathes than on any other lathes in his plant. He attributes this fact to the "American" ideal combination of those qualities which influence production—Power—Accuracy—Ease of Control, Simplicity and Stability.

We can help you to convince yourself if you will simply give us the opportunity.

AMERICAN



ICAN

Duty hes

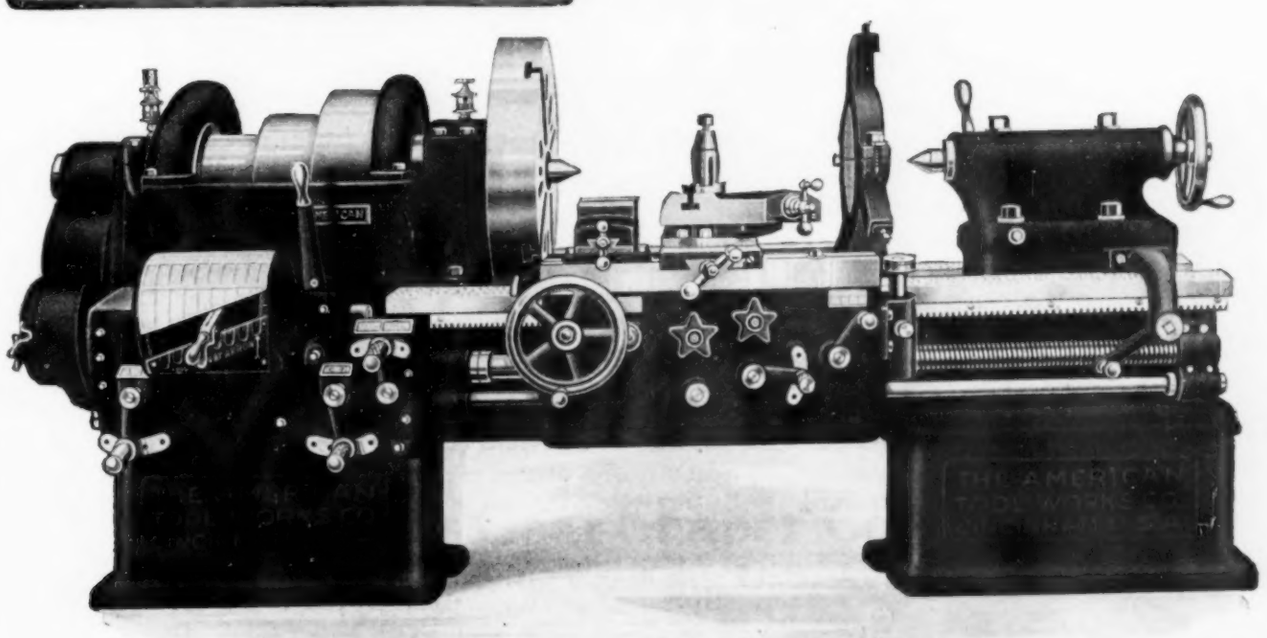
"Can't Beat It for Heavy Work"

Or take the testimony of the Joliet Bridge & Iron Company, of Joliet, Illinois. Their superintendent goes so far as to say you "Can't beat it for Heavy Work." He, too, has found from experience that "American" Lathes are real producers and pace setters for the Lathe Department.

"American" Lathes are built right. They are powerful—they are accurate and they command the consideration of every progressive lathe user. It's your turn now. Just drop us a postal for more information—we'll do the rest.

The American Tool Works Co.
Cincinnati, U. S. A.

AMERICAN



F.G.S.Co. **SERVICE, ACCURACY, PRODUCTION** F.G.S.Co.

An Open Letter to Manufacturers of Special Machinery

Gentlemen:

The manufacture of special machinery calls for ingenuity in design, and a knowledge of special processes of manufacture that a ''straight line'' manufacturer does not have to deal with. Some special machines are operated by cams; others by gears of a variety of types. The production of parts for special machinery, therefore, requires a close study to determine which is the best and least expensive method of manufacture.

The Gear Shaper is not a special machine in any sense of the word. As a matter of fact, gears are only one of the many classes of work to which this general-purpose machine has been adapted with wonderful success. It will cut cams, ratchets, internal or external, special gears of the Geneva stop type, and a variety of other gears not within the range of any other gear cutting machine.

A special machine manufacturer will find that the Gear Shaper is on a par for adaptability with the milling machine, and in some cases will do work that the milling machine cannot handle.

New uses are being found for the Gear Shaper every day. Why not get our opinion regarding how certain parts can be produced--we may be able to offer suggestions, which will prove of value to you.

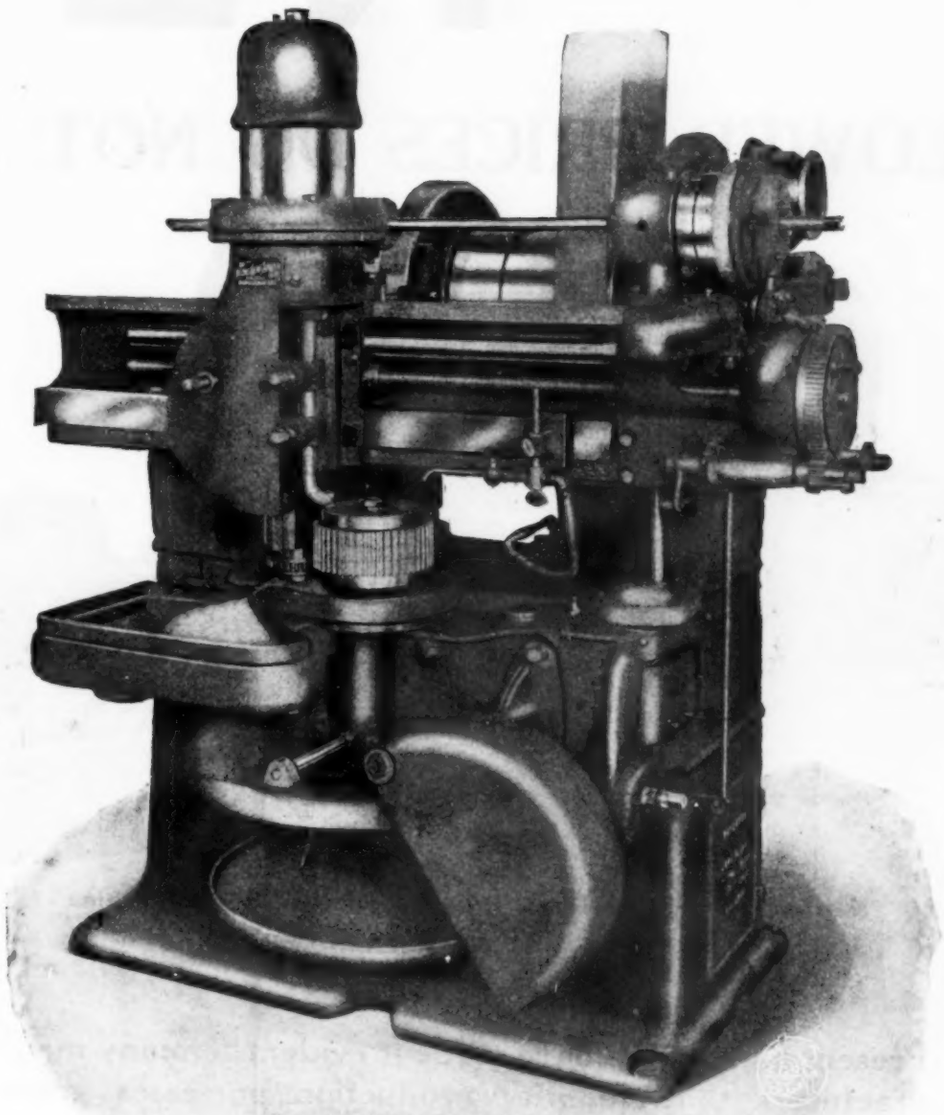
We retain a corps of expert engineers who devote their entire time and attention to the solution of these problems both from the standpoint of design and manufacture. Their services are given gratis. Address your letter attention of our Engineering Department.

THE FELLOWS GEAR SHAPER COMPANY,
Springfield, Vermont, U. S. A.

F.G.S.Co.

SERVICE, ACCURACY, PRODUCTION

F.G.S.Co.



The Fellows Gear Shaper

Noted for its great accuracy, large production possibilities, and wide range of application.

The Fellows Gear Shaper Company

Springfield, Vermont, U. S. A.

FOREIGN AGENTS: Alfred Herbert, Ltd., Coventry, England; Societe Anonyme, Alfred Herbert, Paris, France; Societa Anonima Italiana, Alfred Herbert, Milan, Italy; Alfred Herbert, Ltd., Yokohama, Japan; Societe Anonyme, Alfred Herbert, Barcelona, Spain; Societe Anonyme, Belge, Alfred Herbert, Brussels, Belgium; Alfred Herbert (India), Ltd., Head Office, Calcutta, India.

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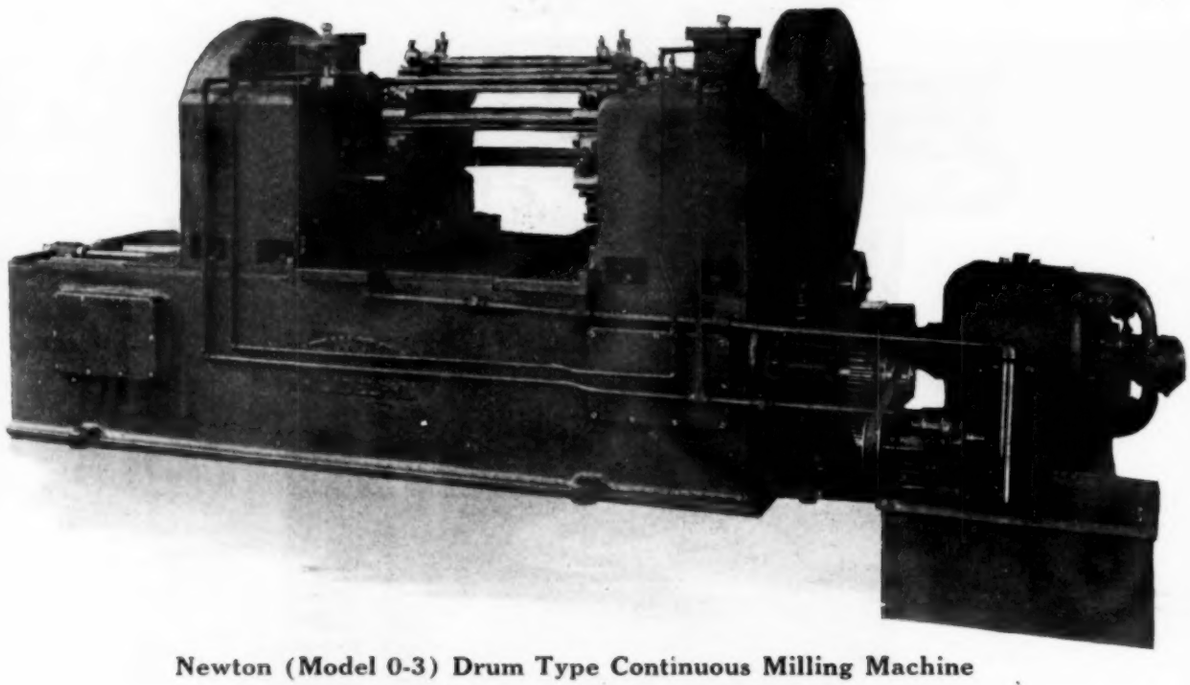
LOWER PRICES DO NOT NECES S



Newton (Model 0-3) Drum Type Continuous Milling Machine

Machining both ends of drive shafts simultaneously at a production of 250 per hour

Present high wages have made it evident to many manufacturers that quantity production possesses great cost-saving possibilities.

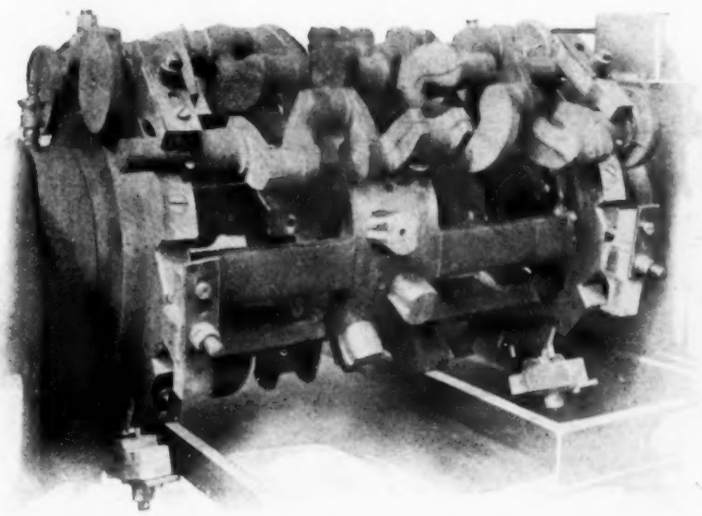
YOU CAN MAINTAIN YOUR PROFITS AT LOWER PRICES BY REPLACING YOUR OLD EQUIPMENT WITH MACHINERY THAT WILL RESULT IN GREATER EFFICIENCY OF LABOR.

NEWTON MACHINE TOOL WORKS, Inc., T

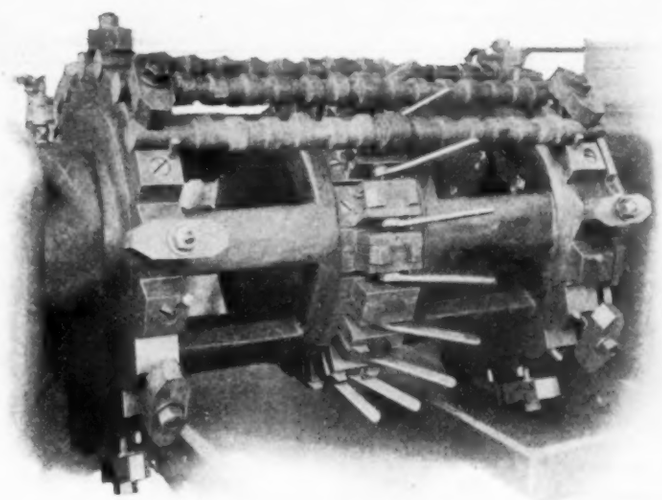
TON

TRADE MARK)

SARILY MEAN LOWER PROFITS

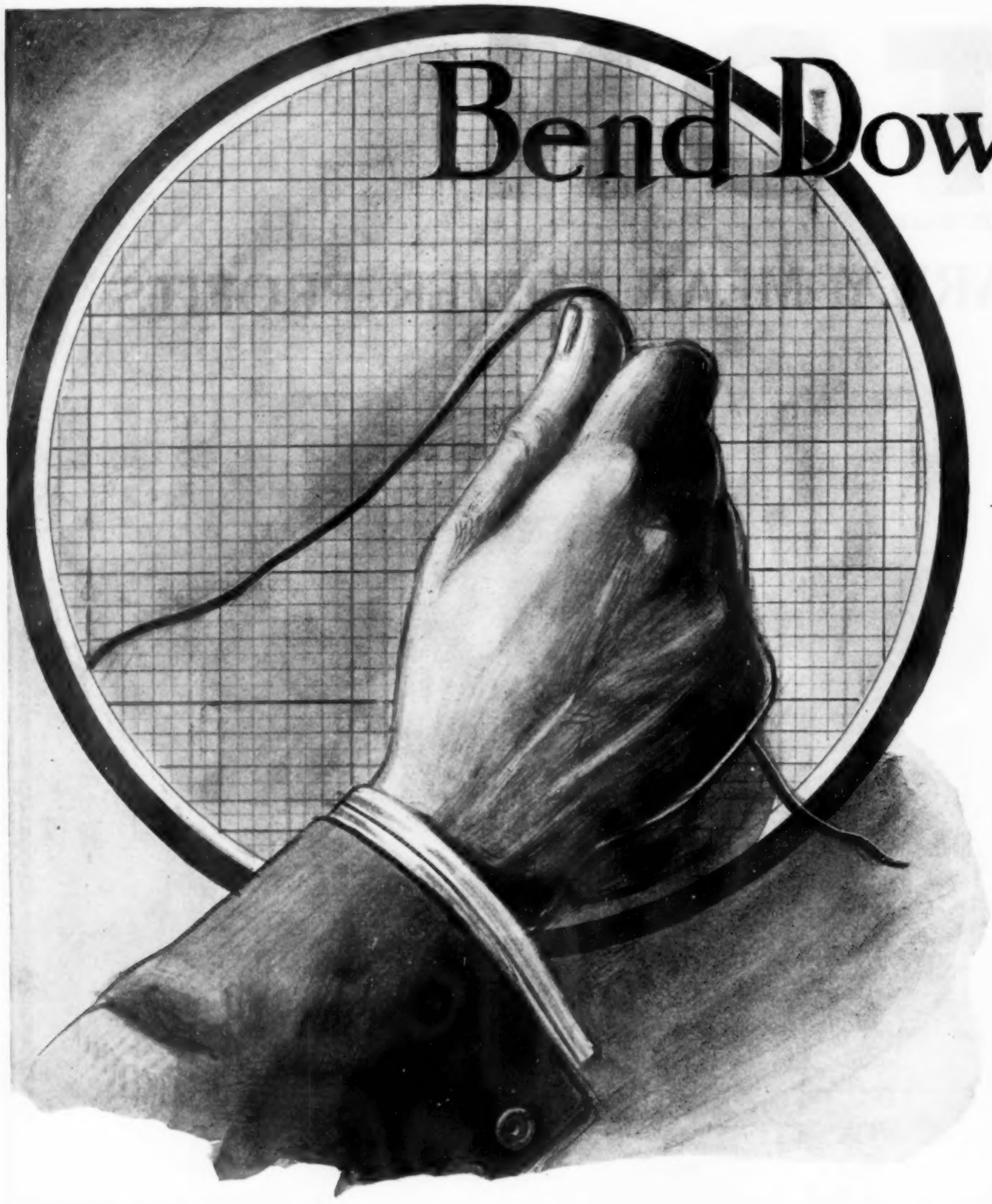


Facing ends of crank shafts. Production—90 per hour



Facing ends of cam shafts. Production—180 per hour

Twenty-Third and Vine Sts., Philadelphia, U.S.A.



New York Office:
Hudson Terminal Bldg., 50 Church St.
Walter H. Foster, Manager

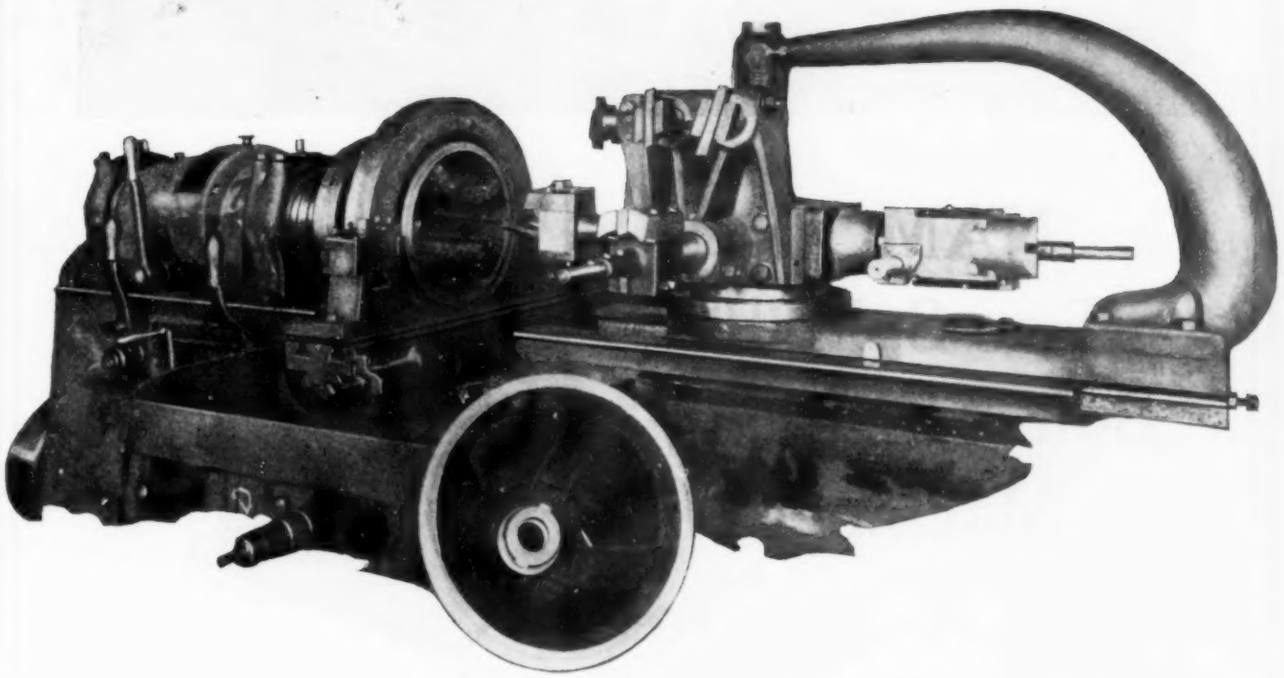
Detroit Office:
The Potter & Johnston Agency Co.
99 Bates St.

Chicago Office:
1001 McCormick Bldg.,
Chas. H. Shaw, Manager

POTTER &

PAWTUCKET,

Your Cost Line
During the Coming Year



Let the P. & J. Automatics shoulder the responsibility. They solve the high cost of operation. They keep production up to the highest notch and bend the cost down to the lowest point on your chart.

The illustration above shows the P. & J. turning out Motor End Frames.

The pieces are held in a fixture and the boring, facing, turning, grooving and reaming is all completed with one cycle of the turret.

One man is attending to three of these machines and all he has to do is to keep the machine fed with work.

The P. & J. means efficiency carried to a point which more than meets the heaviest requirements of production and cost of operation.

We will be glad to let you know what economy the P. & J. can effect to you.

Send along an outline of your work.

JOHNSTON
RHODE ISLAND

Toronto Office: 11 Wellington Street, East, E. C. Roelofson, Manager. Foreign Offices and Representatives: Offices for Great Britain, France, Italy, Belgium, Switzerland, Spain and Portugal. Potter & Johnston Machine Co., 68 Ave. de la Grande Armee, Paris, France, J. Ryan, Manager. Chas. Churchill & Co., Ltd., London, Birmingham, Manchester and Newcastle-on-Tyne, England, and Glasgow, Scotland. Ercole Vaghi, Corso Porto Nouva, 34, Milan, Italy. Rylander and Asplund, Stockholm, Sweden. Yamatake & Company, No. 1 Yurakucho, Ichome, Kojimachiku, Tokyo, Japan.

NAMCO Two-Spindle Bolt Threading Machines

Capacities: 3/16 in. to 3/4 in.

It's the number of pieces per hour that counts

Why not save all the time possible in Threading on NAMCO Bolt Threaders for handling screw blanks, spark plugs and spring clips?

The machine is very simple in operation—two spindles are equipped with NAMCO Self-opening Dies; output is practically continuous since the operator works alternately from one spindle to the other.

Write for our NAMCO Auxiliary Screw Machine Catalog.

THE NATIONAL ACME COMPANY

CLEVELAND, OHIO

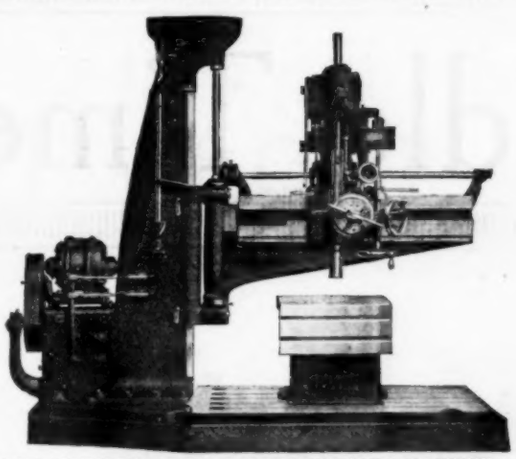
NEW ENGLAND PLANT, WINDSOR, VT. CANADIAN SCREW PLANT, MONTREAL, P. Q.

BRANCH OFFICES: NEW YORK BOSTON CHICAGO DETROIT BUFFALO

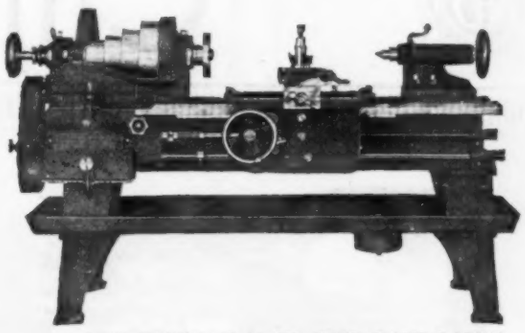
WAREHOUSES: NEW YORK AND CHICAGO

REPRESENTATIVES IN PRINCIPAL FOREIGN COUNTRIES

Makers of Gridley Single and Multiple-Spindle Automatics at Windsor, Vermont; and Acme Automatics, Threading Dies, Collapsing Taps and Screw Machine Products at Cleveland, Ohio



REED-PRENTICE 5 FT. RADIAL DRILLING MACHINE

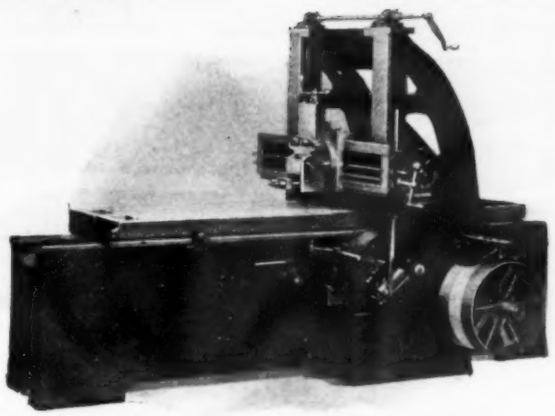


REED PRENTICE 14 IN. TOOL ROOM LATHE

LATHES
Cone Head to 30-in. Swing.
Geared Head to 30-in. Swing.
Semi-Automatic

RADIAL DRILLS
3-ft, 4-ft. and 5-ft. Arms.

PLANERS
20-in. x 17-in. to
42-in. x 42-in.

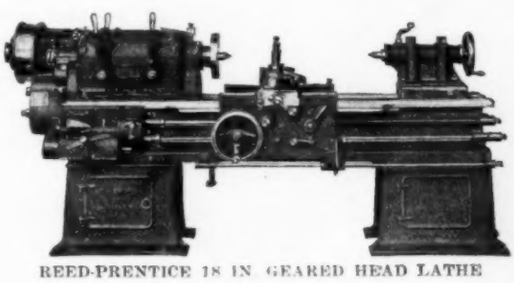


WHITCOMB-BLAISDELL 24 IN. PLANER

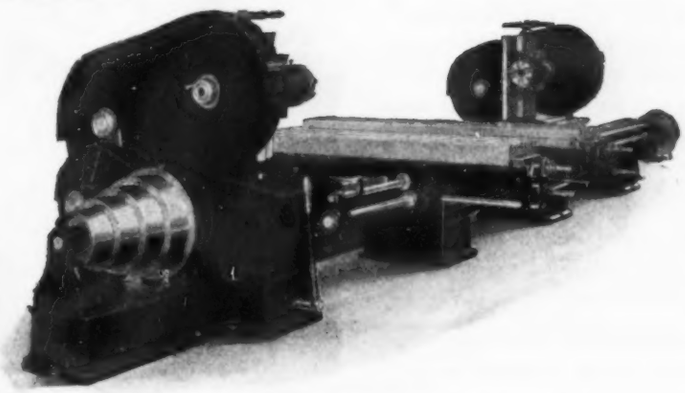
MILLING MACHINES
Vertical
Horizontal
Universal
Die Sinkers
Duplex

MILLING CUTTERS
Standard
Special

PORTABLE SHAPERS
48-in. x 48-in. and
66-in. x 66 in.



REED-PRENTICE 18 IN. GEARED HEAD LATHE



BECKER NO. 44 DUPLEX MILLING MACHINE

Catalogues and Bulletins on Request

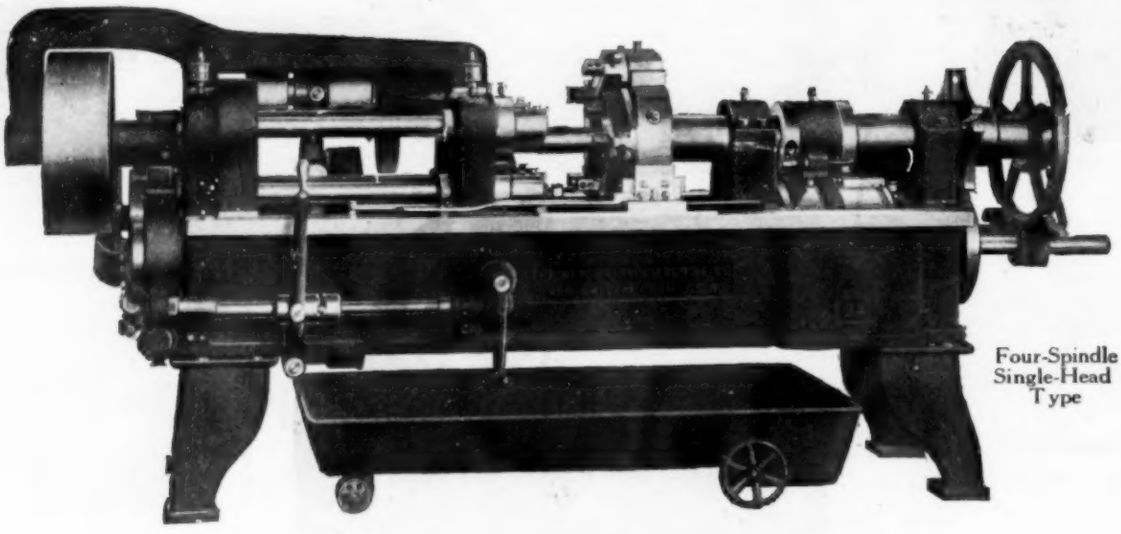
REED-PRENTICE COMPANY
WORCESTER MASSACHUSETTS

WHITCOMB-BLAISDELL MACHINE TOOL CO.
WORCESTER MASS

BECKER MILLING MACHINE COMPANY
HYDE PARK BOSTON, MASS.

MAIN OFFICE: 53 FRANKLIN STREET, BOSTON, MASS.
BUFFALO CHICAGO CLEVELAND DETROIT INDIANAPOLIS NEW YORK PHILADELPHIA

Cut "Idle Time"



Four-Spindle Single-Head Type

IDLE TIME is a *total loss*—a loss, not only of the possible *profit* from a workman's labor, but a dead loss as well of the *wage* paid for such unprofitably-employed time.

It is analagous to the loss of both *interest* and *principal* of an *investment*.

Consequently any *idle* time which can be changed to *productive* time becomes just so much "*clear velvet*."

Universal Work-Holding Turret

There are many causes of idle time but we refer here to that phase whose source lies in *machine design* rather than in the *workman*.

The field of chucked work—*castings, forgings, and second-operation bar jobs*—offers remarkable possibilities for cost cutting through the elimination of idle time.

The use of *turret lathe* or *hand screw machine* on such work involves an extravagant loss of

All Operations Simultaneous and Automatic

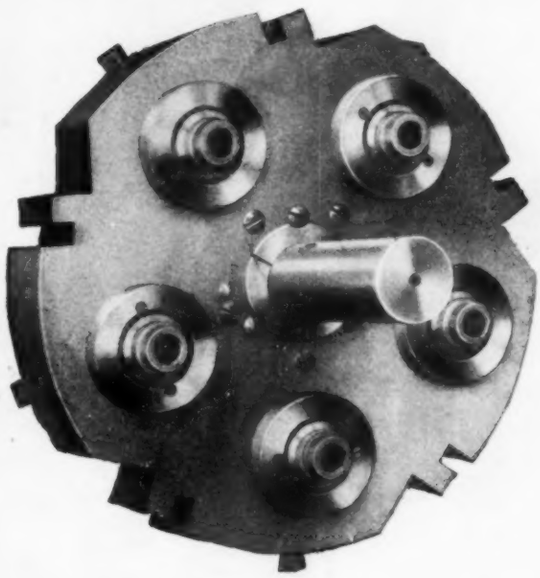
NEW BRITAIN

Off Your Payroll!

time as compared with the *Multiple-Spindle Automatic Chucking Machine.*

With the former machines a series of operations are performed *consecutively* on a *single* piece; with the latter, the same operations are performed *simultaneously* upon *several* pieces.

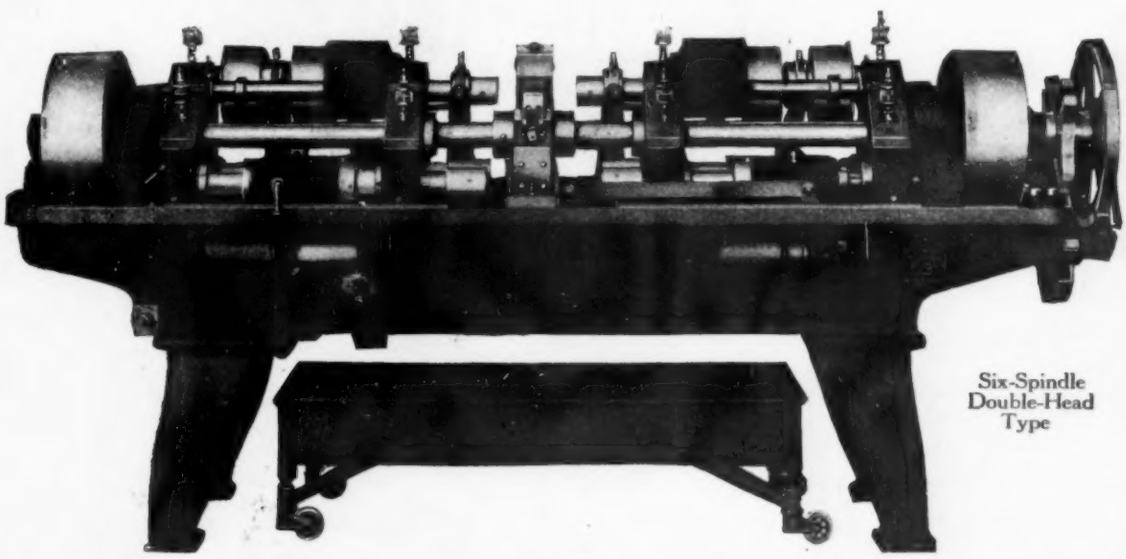
In the one case the *production time* is equivalent to the *sum of the individual operations*, in the other, a *finished piece* is produced in the time of the longest *single operation* (or subdivision thereof.)



The *Multiple-Spindle Automatic* effects a further time economy through the provision of an extra chucking position, *which permits loading and unloading while the tools are cutting.*

Send samples or blueprints of your chucked work and let us show you how much idle time you have on your payroll.

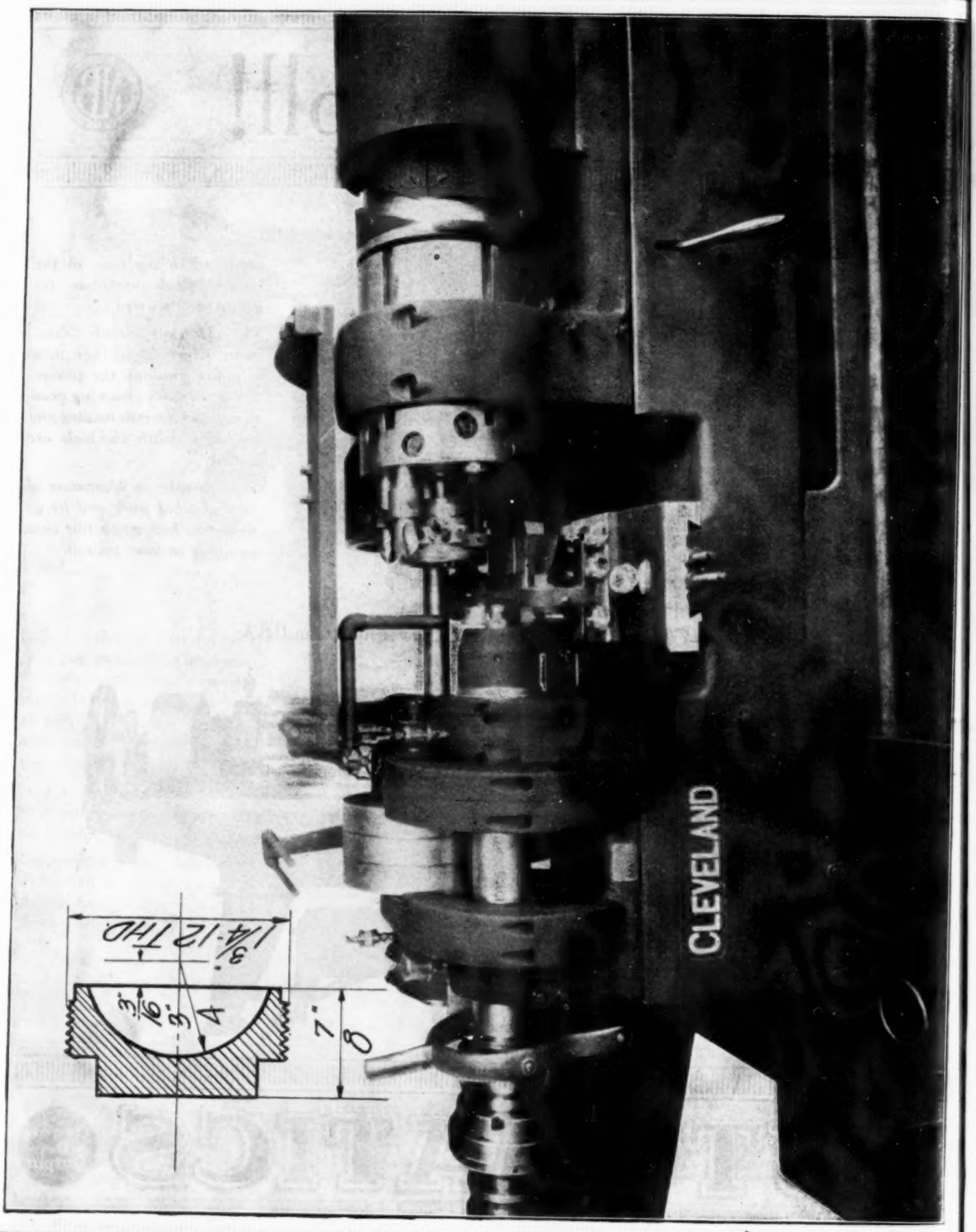
The New Britain Machine Co., New Britain, Conn., U.S.A.



Six-Spindle Double-Head Type

AUTOMATICS

Compare the Output


CLEVELAND
1¼-12 THD
3/16
3
4
7
8

Large Diameter Threading

Cleveland 2½-Inch Model "A" Machine Running On Locomotive Stay Bolt Cap

WORK of this character fits in well on the Cleveland. A very slow and powerful spindle speed for threading is obtained in addition to two other spindle speeds, making it possible to do the heaviest threading work with ease.

The tooling for this job consists of center drill, counterbore, and circular forming tool, No. 6 Modern Die and flat blade cutoff.

Oil is forced through the die head from the rear giving flooded lubrication to the chasers and keeping the chips always washed clear of the die head. The bar seen just above the turret is the closing device for this die head.

The output is 30 per hour, the material being cold rolled steel.

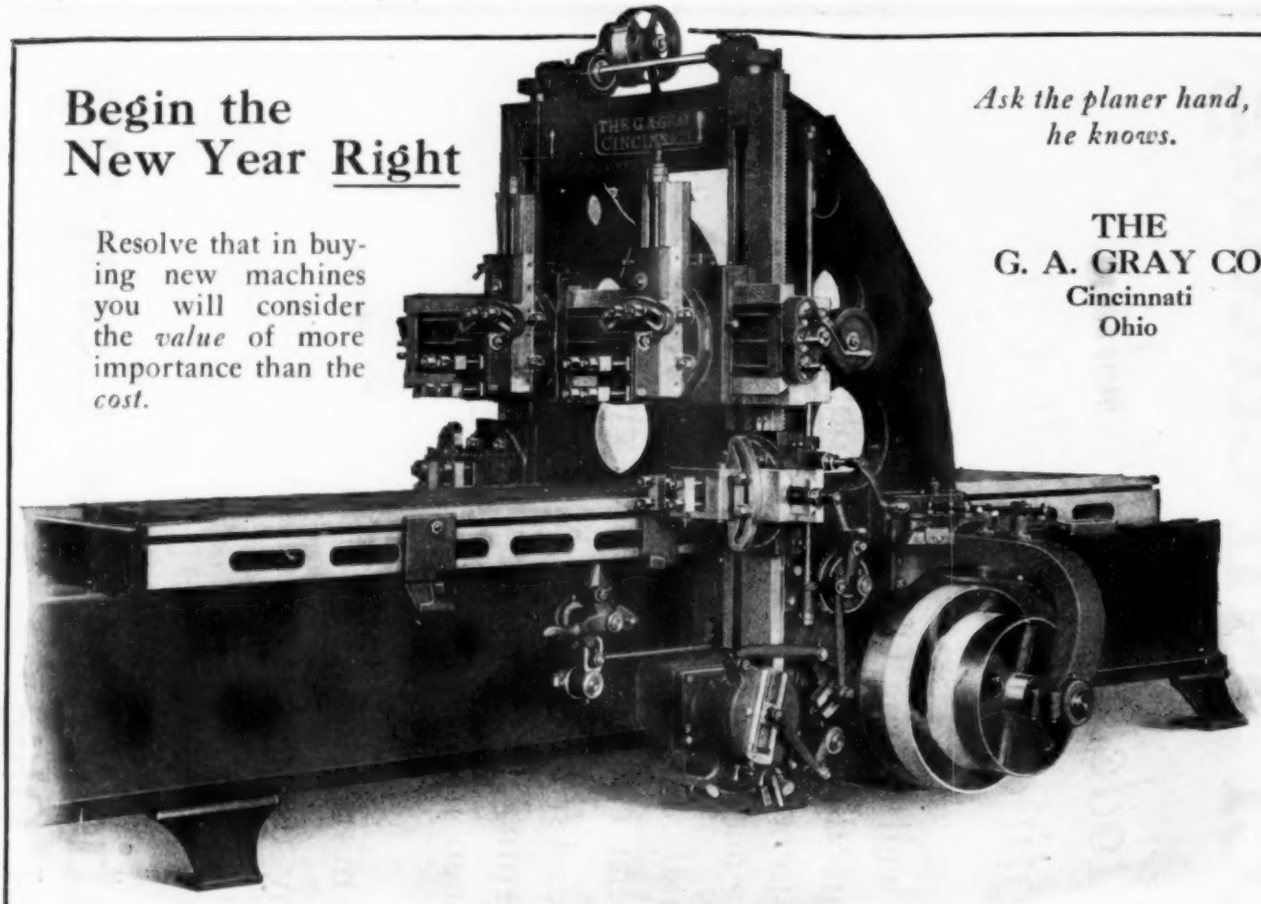
Interchangeability is assured by using Cleveland Automatics on this class of work.

The Cleveland Automatic Machine Company

Cleveland, Ohio

Begin the New Year Right

Resolve that in buying new machines you will consider the *value* of more importance than the *cost*.



Ask the planer hand, he knows.

THE
G. A. GRAY CO.
Cincinnati
Ohio

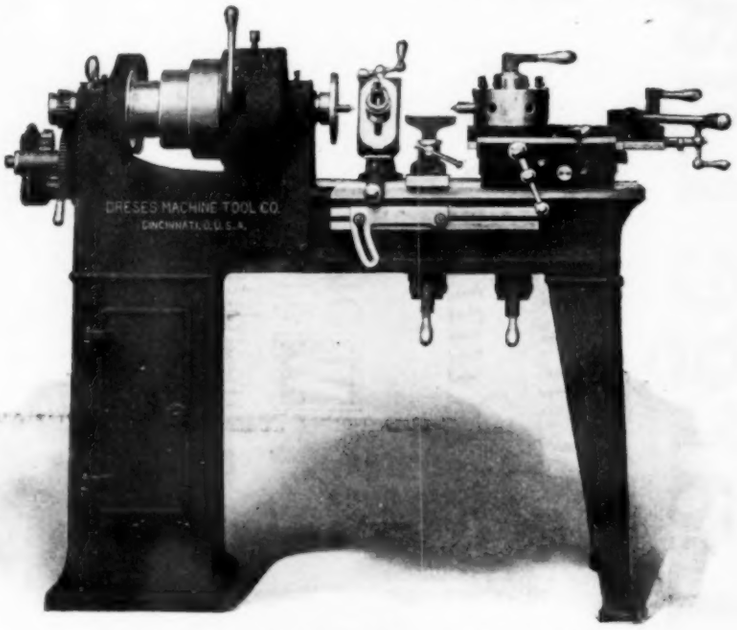
Turret Lathes and Screw Machines

A Complete Line for Brass, Iron and Bar Work

The tail leg is attached in a hinged manner to form a three point support.

DRESES MACHINE TOOL CO.
Cincinnati, Ohio
U. S. A.

Improved and Redesigned



15 in., 18 in. and 20 in. Universal Turret Lathes

IN the bearings sponsored by **SKF** its type of anti-friction bearings have been developed to their highest perfection. And **SKF** further provides an engineering service not only to assure to itself proper application and use of **SKF** marked products but to help the buyer to fully capitalize the mechanical value built into each device. This service is freely offered and is being continually broadened and advanced by laboratory research that is international in scope. You are assured a similar service behind every product bearing the mark—

SKF

Among these products now offered are:

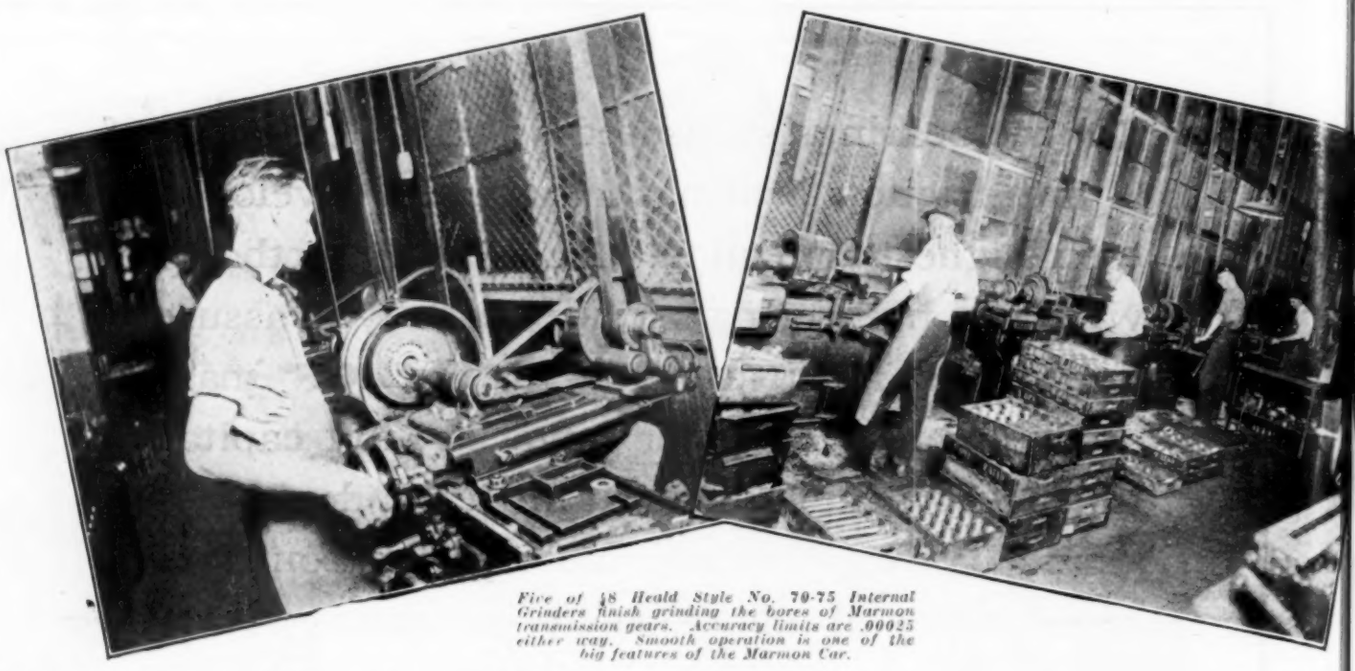
Single row deep groove ball bearings.
Double row self aligning ball bearings.
Thrust bearings.
Steel balls.
Transmission equipment.

SKF Industries, Inc.
165 Broadway, New York City

Supervising at the request of the stockholders
The Hess-Bright Manufacturing Co.
SKF Ball Bearing Co.
Atlas Ball Co.
Hubbard Machine Co.
SKF Research Laboratories

SKF *Research Laboratory established at Philadelphia to co-operate with the Gothenburg Laboratories in the study of the American Manufacturers' friction problems.*

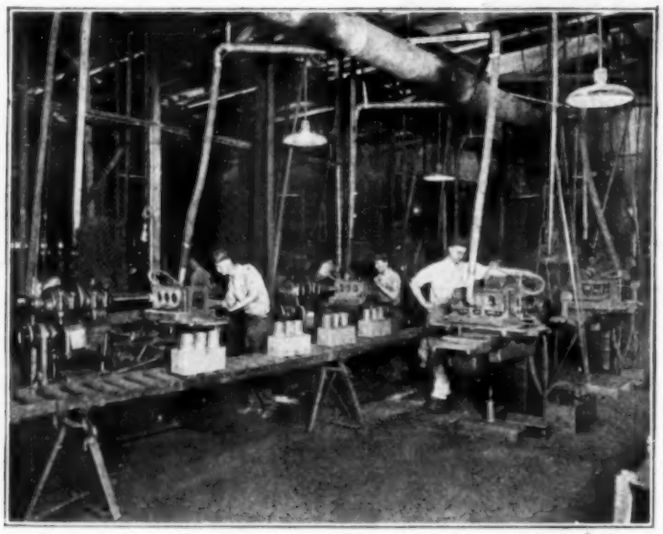
617



Five of 18 Heald Style No. 70-75 Internal Grinders finish grinding the bores of Marmon transmission gears. Accuracy limits are .00025 either way. Smooth operation is one of the big features of the Marmon Car.

The Grinding Department

Three Batteries of 89 HEALDS Finishing



The Marmon people use 27 Heald No. 60 Cylinder Grinders. This photo shows five of the battery finishing the cylinders of the Marmon engine.

The standards to which the Marmon Car is built, as brought out in Marmon literature:

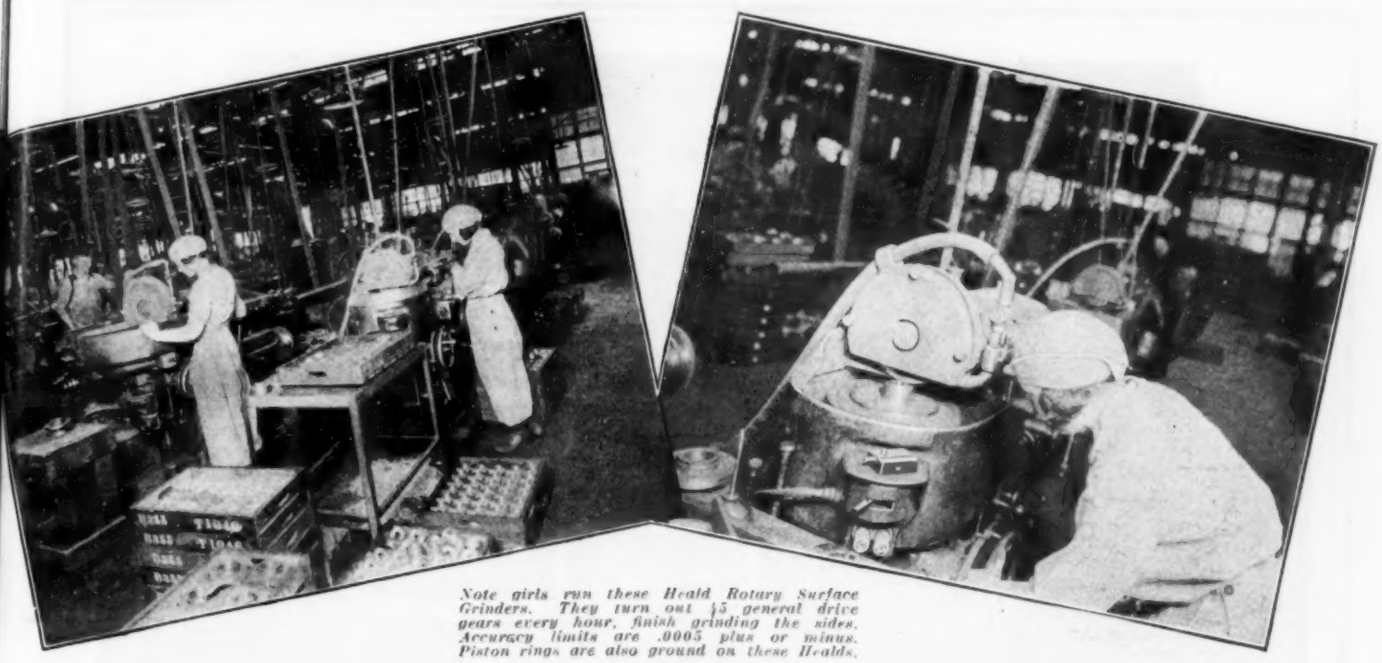
"A motor car built to a new degree of accuracy." Heald Grinding Machines were first installed in Nordyke & Marmon Co.'s plant four years ago. Read again the accuracy limits required on the various grinding jobs illustrated herewith.

"—so smooth in operation, so immune to trouble and wear." Does not this reflect the care devoted to the finishing of gears and the grinding of cylinders?

Take a look into the grinding departments of the larger automotive industries and you will find a battery of at least one style Heald Grinding Machine. Invariably you will find all three styles. Just ask the foreman his opinion.

THE HEALD MACHINE CO.,

BRANCH OFFICES: New York, 839 Singer Bldg.; Philadelphia, 1308 Commonwealth Bldg.; Chicago, 26 South Jefferson St.; Detroit, 401 Marquette Bldg.; Cincinnati, 311 Provident Bank Bldg.; Cleveland, 721 Engineers Bldg. WESTERN AGENTS: Eccles & Smith Co., Los Angeles, San Francisco, Seattle and Portland; Salt Lake Hardware Co., Utah and Idaho; Hendrie & Bolthoff Mfg. & Supply Co., Colorado and Wyoming.



Note girls run these Heald Rotary Surface Grinders. They turn out 55 general drive gears every hour, finish grinding the sides. Accuracy limits are .0005 plus or minus. Piston rings are also ground on these Healds.

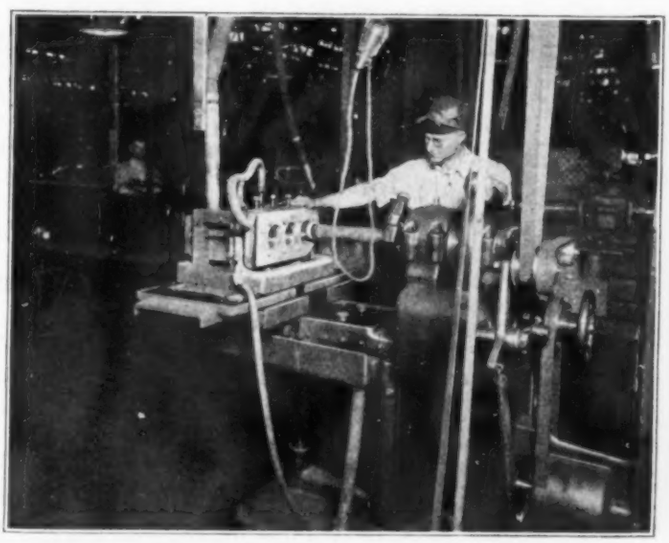
Behind the Marmon Car

Gears, Cylinders and Piston Rings

"A motor car that truly reflects the great lessons we learned in building aircraft engines for the government." War production was at fever heat when Heald Cylinder Grinders were getting into action in the Marmon plant. The Marmon people have learned the truth of our slogan—*"Grind with a Heald and be sure."*

In their reports on Heald performance they speak only in complimentary terms—just as you would speak if you were a user.

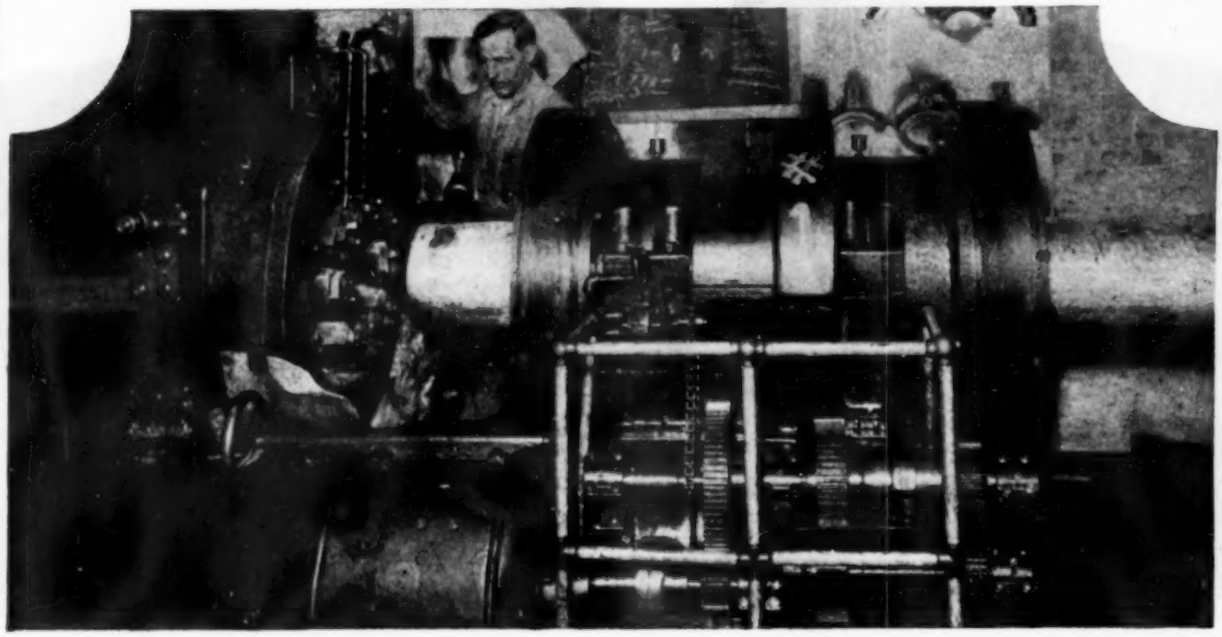
You don't have to go to the expense of experimenting to determine whether or not you can profitably use Healds. Send us your blueprints and work. If a Heald can't improve upon your methods you'll find it out.



A close up of one of the battery of Heald Cylinder Grinders. The Marmon people are convinced that only by grinding can a true, round hole to .0005 plus be obtained.

35 New Bond St., Worcester, Mass.

FOREIGN AGENTS: Alfred Herbert, Ltd., England; Societe Anonyme Alfred Herbert, France, Switzerland; Societe Anonima Italiana, Alfred Herbert, Italy; Horne Co., Ltd., Japan; Wilh. Sonesson & Co., Sweden, Denmark and Norway; Henri Benedictus, Brussels, Belgium; American Machinery Corporation, Madrid, Spain; Sindicatio de Maquinaria Americano, Bilboa, Spain.



Landis Pipe Threading Machine

The Walworth Mfg. Co., New York, were interviewed regarding the performance of their Landis Pipe Threading Die Heads and Machines. Here are two of the questions and answers.

Q. **How long do your chasers run without regrinding?**

A. **Those on the machine shown have not been touched for a year**

Q. **How long does it take to cut a thread?**

A. **Three inch pipe thread, 20 seconds, twelve inch, three minutes.**

The operator claims his Landis is the best pipe threading machine made and that a day's work on it does not tire him.

Profit by the experience of hundreds of firms using Landis Threading Machines. Avoid trouble and be assured of good threads, high production and low cost of upkeep by installing a Landis in your plant *now*.

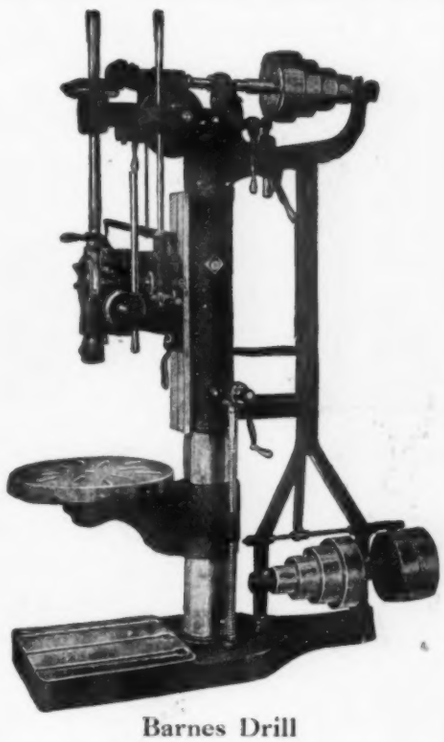
Write for catalogue and send us your specifications. We will be glad to show you why the Landis pays.

Landis Machine Company, Waynesboro, Pa.

Complete Line of 8 inch to 50 inch Swing (with or without Tapping Attachment)

Upright DRILLS
Horizontal DRILLS
Gang DRILLS

Convenience of Operation
Accuracy—Strength



Barnes Drill

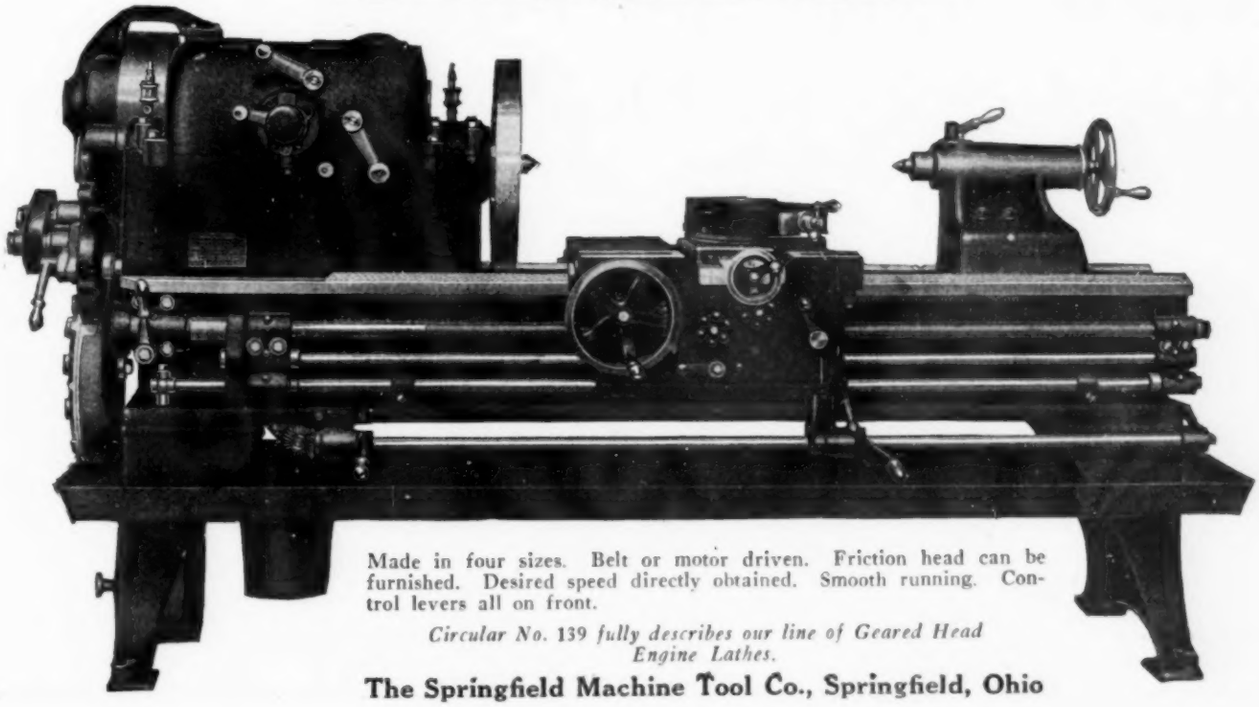
TRADE W.F. AND J.B. MARK

Made by

W. F. & JOHN BARNES CO.
1995 Ruby Street, Rockford, Ill., U. S. A.

SPRINGFIELD—IDEAL

A Geared Head Engine Lathe of High Power, Correct Speeds, Rapid Change Gearing Facilities, High Efficiency Together with Long Life.

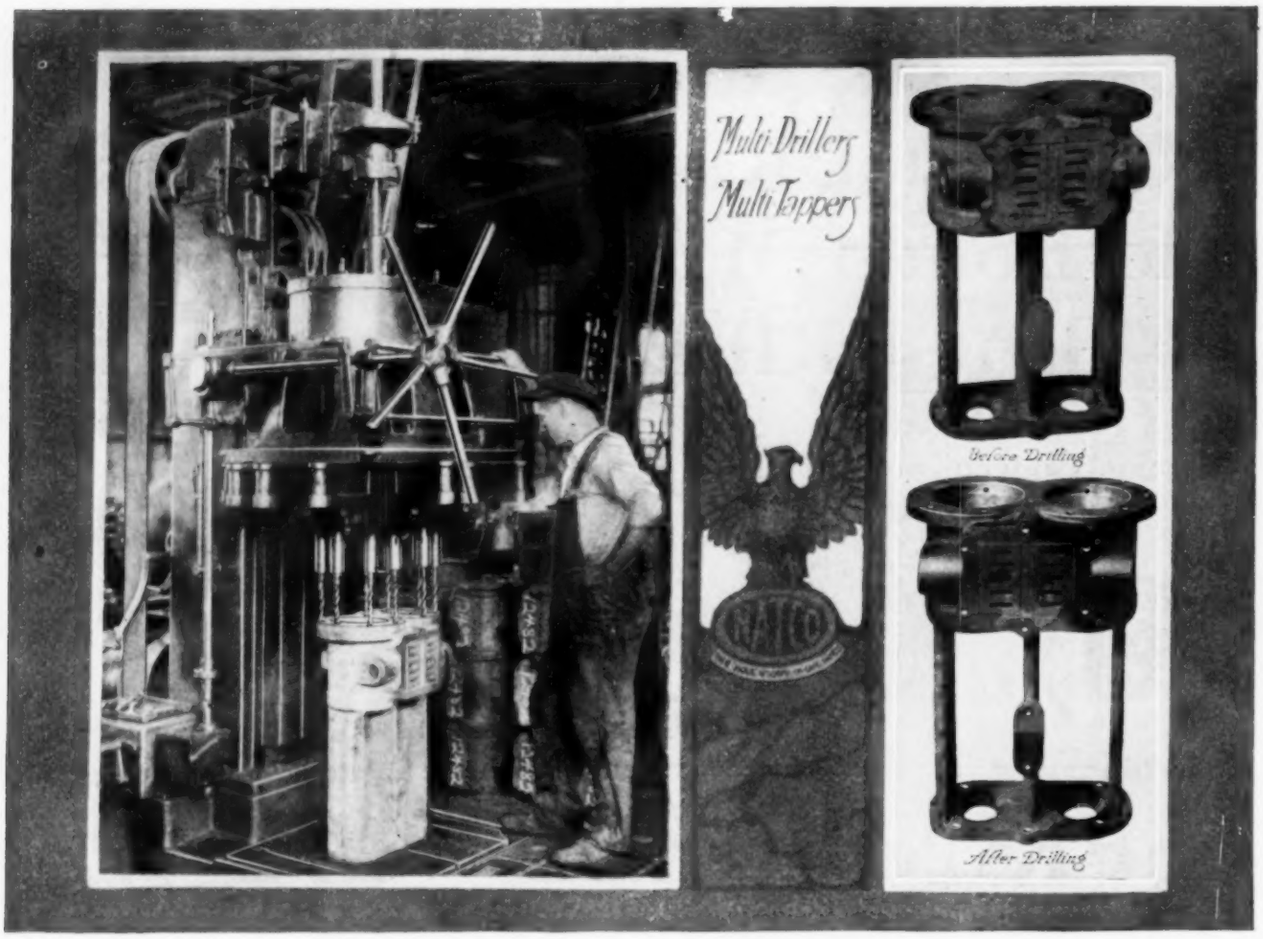


Made in four sizes. Belt or motor driven. Friction head can be furnished. Desired speed directly obtained. Smooth running. Control levers all on front.

Circular No. 139 fully describes our line of Geared Head Engine Lathes.

The Springfield Machine Tool Co., Springfield, Ohio

MULTI-DRILLERS NATCO MULTI-TAPPERS



Natco Drilling Steam Cylinder and Yoke for Duplex Steam Pump

Here we see the NATCO in the plant of Vogt Brothers Mfg. Co., Louisville, Ky., drilling cast-iron cylinders and yokes for Duplex Steam Pumps. 30—¾ in holes are drilled in each piece, depth—1½ in. 12 holes are drilled at one setting. The present production with the NATCO is 20 per hour as against 4 per hour by former methods. And in addition to this big increase in production NATCO has reduced drill breakage to nothing.

These remarkable results are due principally to the *strictly NATCO Patented Feature* that makes possible an *Independent Change of Speed for Each Individual Spindle.*

This time saving feature is used on *NATCO Multi-Drillers exclusively.* The speed of every spindle is independent of the speed of every other spindle and may be changed at the will of the operator to approximately the correct speed required for the size and type of tool being used. All spindles not in use are thrown into neutral, saving wear and power.

All manufacturers who have use for, or are contemplating the installation of Multiple Spindle Drilling Machines should give careful consideration to our Independent Drill Speeds, One-Nut Adjustable Spindle and guaranteed Universal Joints —exclusive features that make the NATCO the most economical Multi-Driller on the market.

We also design and build jigs and fixtures for use in connection with NATCO Multi-Drillers and Multi-Tappers.

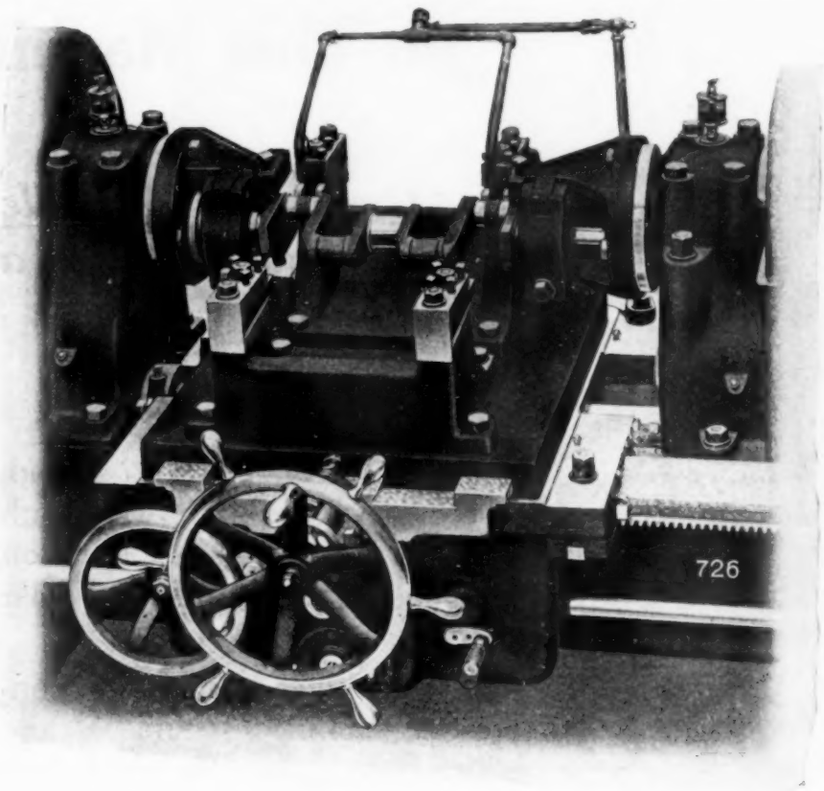
The National Automatic Tool Co., Richmond, Ind., U. S. A.

Largest exclusive manufacturers of Multi-Drillers and Multi-Tappers

List of NATCO Domestic and Foreign Agents

Henry Prentiss & Co., New York City, Buffalo, N. Y., Boston, Mass., Syracuse, N. Y., Rochester, N. Y., Hartford, Conn., Scranton, Pa.; W. E. Shipley Machinery Co., Philadelphia, Pa.; Motch & Merryweather Machinery Co., Pittsburgh, Pa., Cincinnati, Ohio; Strong, Carlisle & Hammond Co., Cleveland, Ohio, Detroit, Mich.; Marshall & Huschart Machinery Co., Chicago, Ill., Milwaukee, Wis.; Burton, Griffiths & Co., British Isles; E. Isbecque Co., Belgium; Aux Forges de Vulcain, France; Allied Machinery Co. of America, Italy, Spain, Portugal and Switzerland; Chr. A. Herstad, Norway, Sweden and Denmark.

Turning Crankshafts by the DUPLEX METHOD



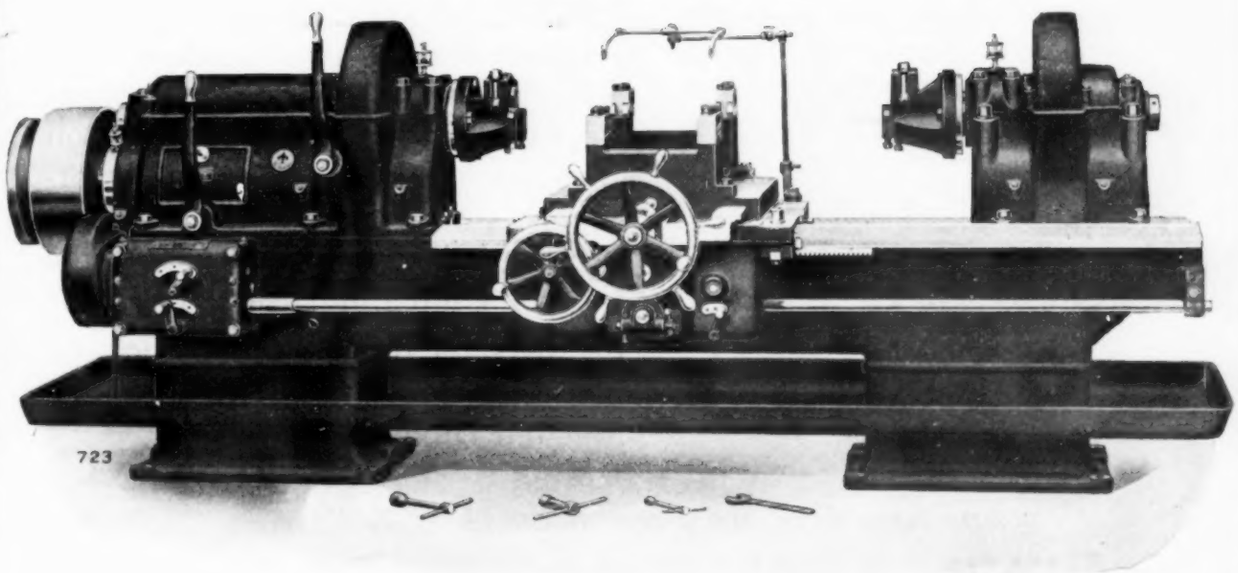
The equipment consists of two Duplex Crank Lathes tooled for the outside and the adjacent pins.

The two pins in the same plane are turned simultaneously, the front tools turning the pin and the rear tools forming the fillets. Positive stops limit the travel of the slide to insure duplication of sizes and a uniform grinding allowance.

The fixtures are provided with quick acting, hinged clamps to facilitate the removal of the finished crank.

The head and tailstock are power driven to prevent torsional strains in the crank.

The average time per pair of pins is two minutes.

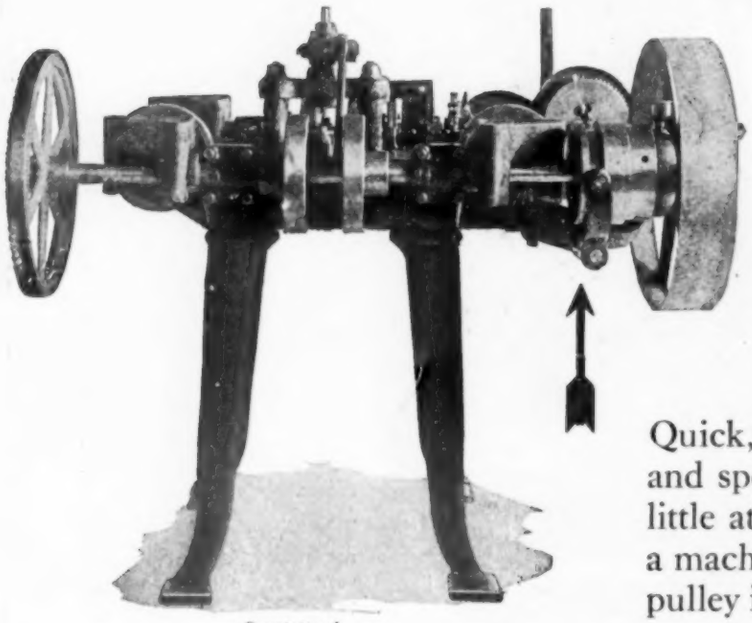


The R.K.Le Blond Machine Tool Co.

Cincinnati.Ohio.

THE JOHNSON FRICTION CLUTCH

No Tight and Loose Pulleys on This Machine



Courtesy of the E. J. Manville Machine Co., Waterbury, Conn.

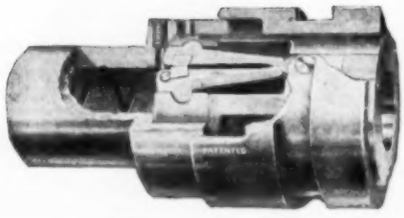
The E. J. Manville Machine Co. uses a Johnson Clutch.

Quick, convenient control, smooth and speedy response, long wear with little attention—a Johnson Clutch on a machine is all that a tight-and-loose pulley is not.

The best machines are clutch controlled, and machine builders who aim at quality have learned to place their confidence in Johnson Clutches.

Manville No. 1 Automatic Four Slide Wire Forming Machines, for example, have been equipped with Johnson Clutches for years. They have thoroughly proven the efficiency of a clutch drive, and the durability of the Johnson Clutch in particular.

Let us send our Blue Catalog and Booklet, "Clutches As Applied To Machine Building."

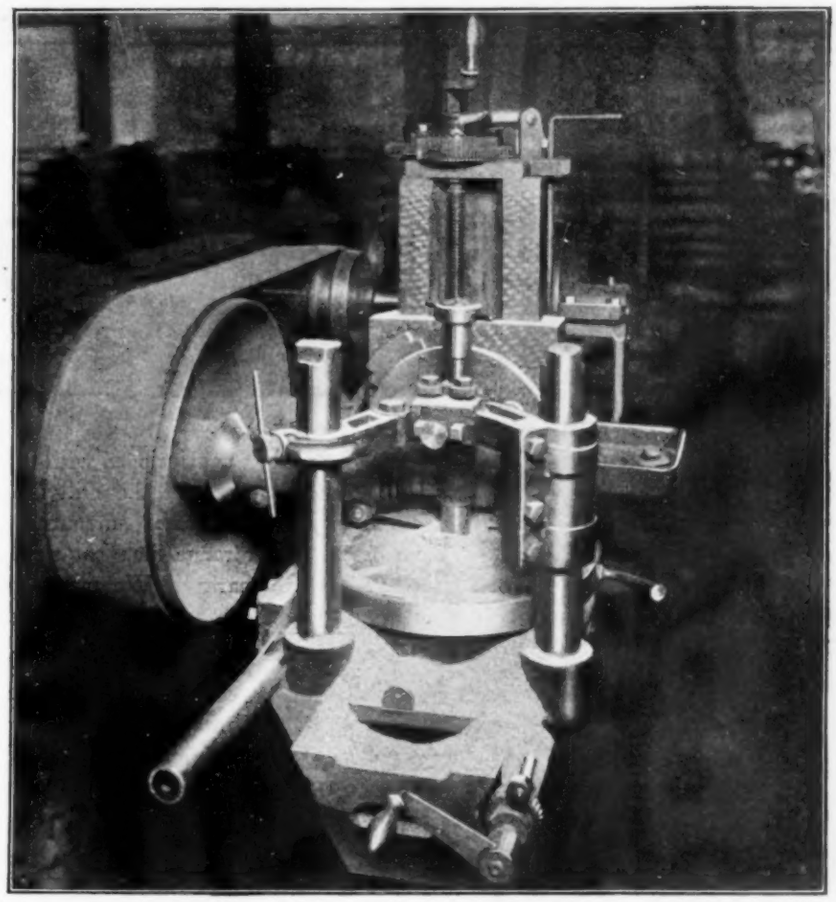


Johnson Single Clutch broken away

FOREIGN AGENTS:

CANADA: Williams & Wilson, Ltd., 84 Inspector St., Montreal. The Canadian Fairbanks-Morse Co., Ltd., Montreal and branches. ENGLAND: The Efandem Co., Ltd., 22 Newman St., Oxford St., London, W. 1. AUSTRALIA: Edwin Wood, Pty., Ltd., 231 Elizabeth St., Melbourne, Victoria. FRANCE: Anciens Etab. Glaenzer & Perreaud, 18 Faubourg du Temple, Paris. SPAIN: R. D'Aulignac, Cortes 559, Barcelona. BELGIUM: Louis Reyners, Rue de la Buanderie 11, Brussels. HOLLAND: Louis Reijners, Meeuwenlaan, 98-100, Amsterdam. DENMARK and SWEDEN: Wilh. Sonesson & Co., Copenhagen and Malmo. NORWAY: Oscar C. M. Knudsen, Odinsgate 4, Christiania. ARGENTINA: Pedro Merlini, Calle Defensa 124, Buenos Aires. INDIA: J. D. Jones & Co., 56 Esplanade Road, Fort Bombay.

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN



The Farwell Gear Hobber

"We find this machine very efficient. We have little trouble staying within close limits of accuracy. It is well adapted for our work."

FRANK MAYER, ***Foreman***
Badger Meter Co., Milwaukee, Wis.

THE simple operation, the strong, rigid construction of the No. 1 Farwell Gear Hobber is responsible for Mr. Mayer's statement.

The illustration shows the table and work arbor of the No. 1 Machine. Bronze meter gears are being generated (dia., 1.739; .005), at an average of 27 per hour.

Farwell Gear Hobbers are made in several styles and sizes.

Ask for Catalogue No. 809.

THE ADAMS COMPANY, **1901 Bridge Street**
Dubuque, Iowa, U. S. A.

Established 1883

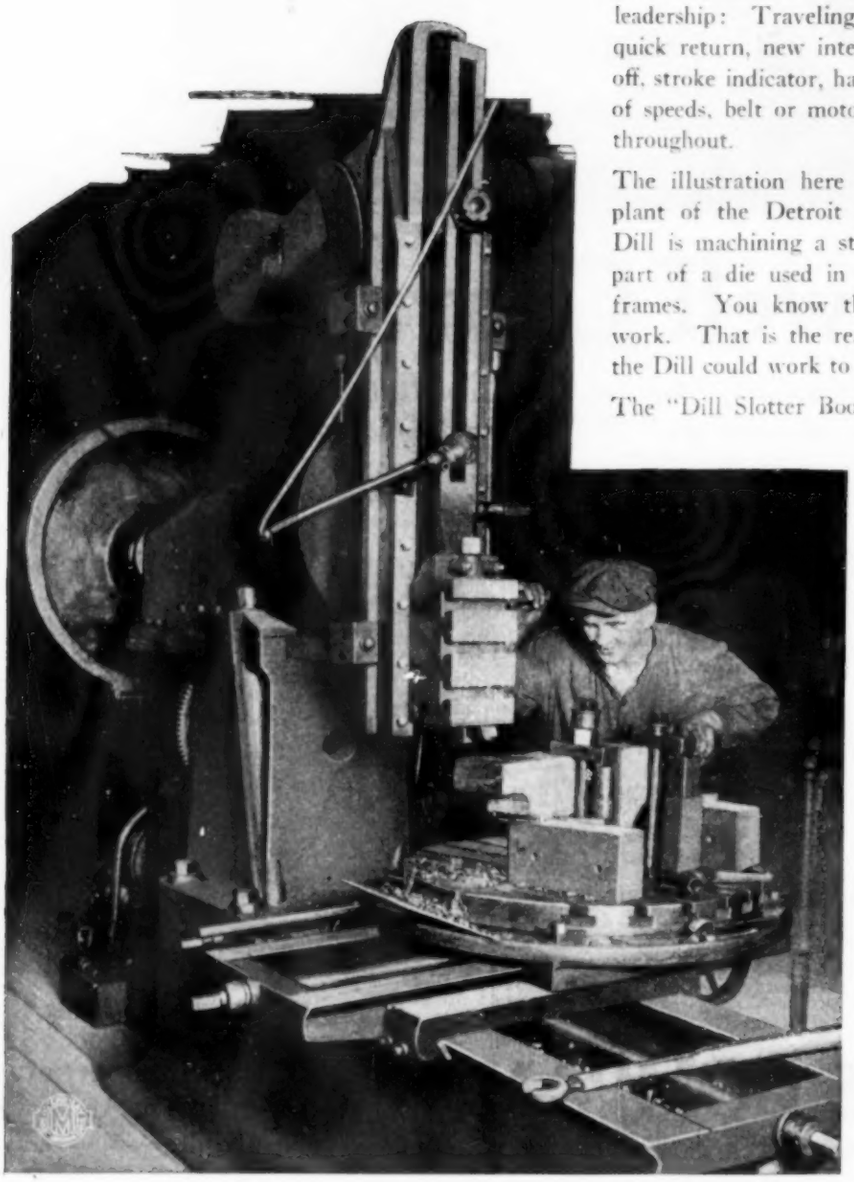
Why, Sure the DILL SLOTTER Can Work to Close Limits

The Dill Slotter was developed with that idea in mind. The universal success of the Dill is due to the fact that it produces a greater amount of accurate work and has a greater range than any similar machine, we believe, on the market. We may be wrong, but no one has been able to demonstrate it so far.

Here are some of the reasons for the Dill Slotter leadership: Traveling head, quick traverse gear, new quick return, new intermittent feed, automatic knock-off, stroke indicator, hand wheel controller, six changes of speeds, belt or motor drive, and heavy construction throughout.

The illustration here shows a Dill at work in the plant of the Detroit Pressed Steel Company. The Dill is machining a steel forging that is to form the part of a die used in the manufacture of automobile frames. You know that die work must be accurate work. That is the reason we said at the outset that the Dill could work to close limits.

The "Dill Slotter Booklet" explains everything.

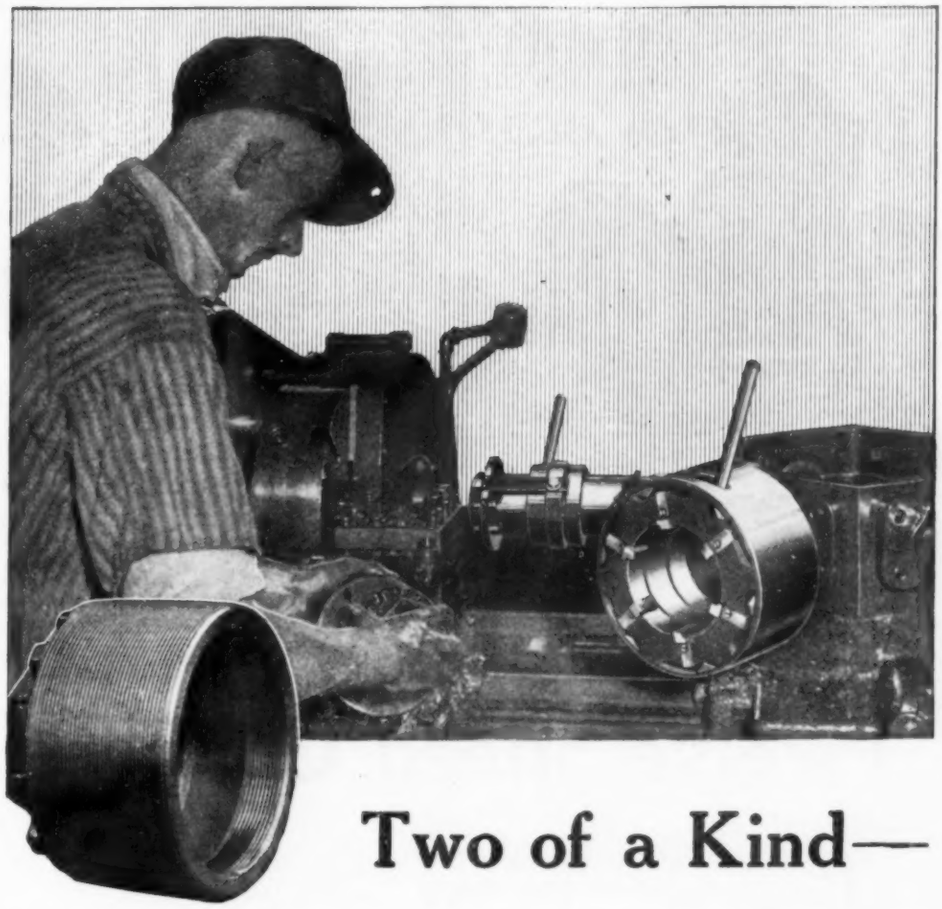


T. C. Dill Machine Co., Inc.

The Dill Slotter People

Philadelphia, Pa.

FOREIGN AGENTS: Alfred Herbert, Ltd., British Isles; Alfred Herbert, Ltd., Yokohama, Japan; Societe Anonyme Belge, Alfred Herbert, Brussels, Belgium; Societe Anonyme, Alfred Herbert, Ltd., Paris, France; Societa Anonima Italiana, Alfred Herbert, Ltd., Milan, Italy.



Two of a Kind—

Here's a NAMCO Collapsing Tap cutting a 3-½-16 Whit. thread on the inside of this pinion bearing adjuster; and a NAMCO Self-opening Die cutting a 4-⅛-16 U. S. S. thread on the outside.

Nothing extraordinary we'll admit, but nevertheless showing the innumerable uses to which these NAMCO Thread-cutting tools are put.

Where there's one, you'll find another. The reason is because they "stand up."

We have a catalog for you.

THE NATIONAL ACME COMPANY

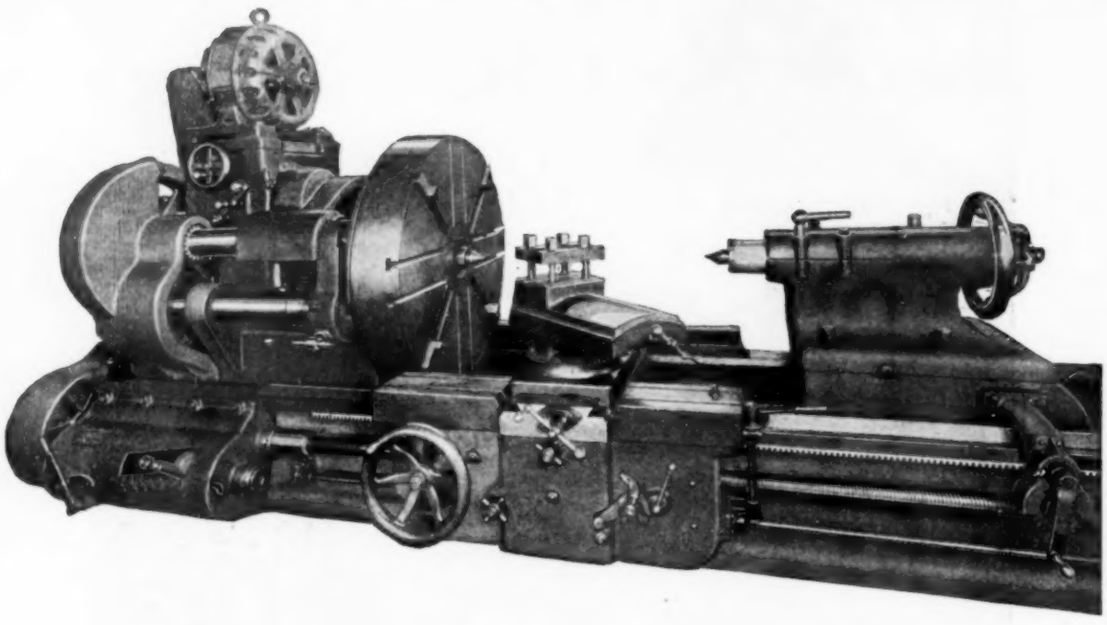
CLEVELAND, OHIO

NEW ENGLAND PLANT, WINDSOR, VT. CANADIAN SCREW PLANT, MONTREAL, P. Q.

BRANCH OFFICES: NEW YORK BOSTON CHICAGO DETROIT BUFFALO
WAREHOUSES: NEW YORK AND CHICAGO
REPRESENTATIVES IN PRINCIPAL FOREIGN COUNTRIES

Makers of Gridley Single and Multiple-Spindle Automatics at Windsor, Vermont; and Acme Automatics, Threading Dies, Collapsing Taps and Screw Machine Products at Cleveland, Ohio

PITTSBURGH



Twelve Speed Changes

POWER—power to excess is embodied in this Pittsburgh Triple Geared Lathe, which enables you to turn the heaviest piece with ease and speed.

It is provided with twelve changes of speed with A. C. motor drive. The motor drive for direct current is mounted directly over the head stock and is driven with a Morse silent chain or endless belt with automatic belt tightener, which gives a smooth and durable drive.

The apron is of double plate construction. A locking device prevents the throwing in of two feeds at once.

The taper attachment is of rigid construction.

Get in touch with us or with our nearest agent, and learn full details

PITTSBURGH MACHINE TOOL CO.

Braddock, Pa., U. S. A.

OR THE FOLLOWING AGENTS: Swind Machinery Co., Philadelphia, Pa.; Backer Machine Tool Supply Co., New York; Wolverine Machinery & Supply Co., Detroit, Mich.; W. C. Johnson & Sons Machinery Co., St. Louis, Mo.; Hendey Machine Co., Chicago, Ill.; Harold A. Wright, 201 Devonshire St., Boston, Mass.; Herberts Machinery & Supply Co., San Francisco and Los Angeles; Hess, Schenck Co., Cleveland, Ohio.

Note what VAN NORMAN flexibility can save you!

In floor space Equipment and Time

Van Norman Duplex No. 3

In one machine, the Van Norman Duplex, you can combine all the functions of the ordinary Horizontal Miller, and the Vertical Miller, and besides perform many unusual operations not possible on any other machine. The saving in floor space is no small item—the saving in original investment of several machines is obvious.

But the best feature of the "DUPLEX" is its saving in time—the costliest item in any shop. Any angle from vertical to horizontal, in any plane, can be milled at one clamping of the work—without removing the cutter. Simple adjustments, as shown above, will enable the same right-end mill to cut any irregular curve from a flat surface to a true circle.

The elimination of costly jigs and fixtures will in itself frequently pay for the Van Norman, on special work.

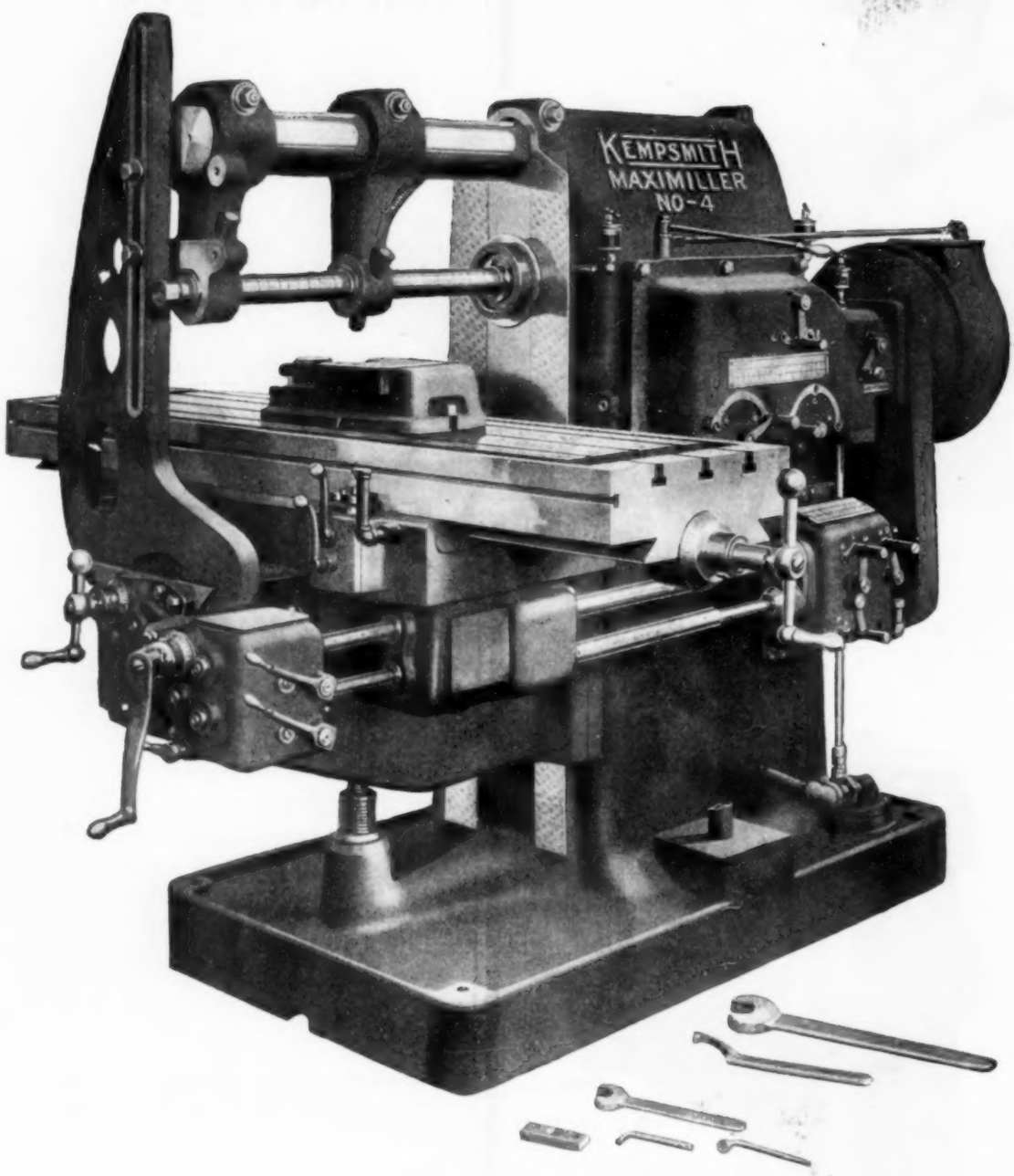
We will gladly discuss the relation of the Van Norman Duplex to your shop.

Van Norman Machine Tool Co.
Office and Factory, 160 Wilbraham St.
Springfield, Mass., U. S. A.

New York Sales Offices: 30 *Church Street*

Detroit Sales Offices: 74 *Brush Street*

Power Rapid



KEMPSMITH No. 4 Plain Maximiller

Traverse in Three Directions

100-in. per min. Either direction of table.
36-in. per min. Transverse movements.
36-in. per min. Vertical movements.

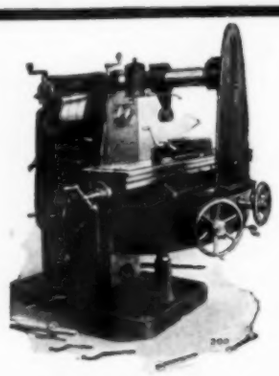
And they all operate entirely independent of the feed that is in use.
THERE ARE OTHER FEATURES such as:

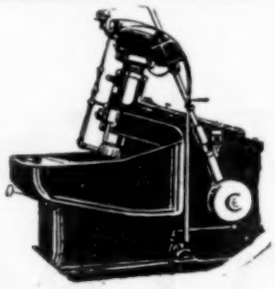
Wedge Locked Overarm
Clutched Spindle Nose
Solid Top Knee
etc., etc.

Which are fully illustrated and described in our Bulletin No. 31-B

Write for a copy today.

KEMPSMITH MILWAUKEE, U.S.A.





Today We Are Thankful

We enjoy a true feeling of thankfulness on this occasion because our past efforts to relieve the manufacturer of a goodly portion of his equipment troubles has been realized.

We have put an overdose of our *best* in every machine tool that has passed through our shipping department.

The Ohio Milling Machine is a complete example of our endeavor. It has no frills nor furbelows to add to cost and detract from operating ease but it does have every required feature for the furtherance of speedy and accurate output. It was built for *service* and it lasts a lifetime in giving same.

The Ohio Tilted Rotary Milling Machine is a number of steps ahead of the times from a production viewpoint. It is equally economical and precise on both station and continuous milling. Equipped with either standard or special work-holding fixtures it has no peer in the automotive field. It readily takes the place of four machines and their usual operators and, in addition, saves floor space power, belting and initial installation expense.

Ohio Grinding Machines have become an hourly necessity in the toolroom. It accurately fashions, remodels and resharpens reamers, cutters and scores of other toolroom equipment in the minimum of time. It is easy to set up, may be adjusted to a "hair" and causes no operating strain.

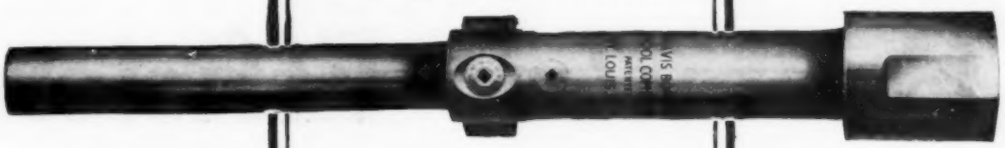
Yes, we are thankful that we have been able to produce such efficient and long-lasting machine tools and you will be, too, if you heed our advice and look over the Ohio Line. Your request for a catalog will prove your interest in manufacturing economy.

OESTERLEIN MACHINE CO, Cincinnati, Ohio

MILLERS OHIO GRINDERS

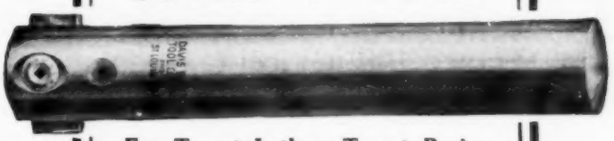
"TOOLS IN WHICH EVERY OUNCE WORKS"

STYLE "E" TOOL



Indispensable for Turret Lathes

STYLE "V" TOOL



For Turret Lathes, Turret Boring Mills, etc.

STYLE "O" TOOL

For Miscellaneous Boring

For All General Work

MICROMETER ADJUSTMENT

A practical micrometer adjustment which expands the cutters to compensate for wear, insures absolute accuracy of bore, at the fastest feeds and speeds. The micrometer screw, graduated in .001 of an inch, controls the travel of a patented, double expanding wedge, which forces the cutters out, uniformly, as the screw is turned.

Davis Expansion Boring Tools

EXPANDING CUTTERS

Cutters are expanded accurately by a special wedge which has perfect bearing against angle on cutters as shown by arrows in illustration.

Liberal cutter expansion insures maximum service per pair and when cutters have reached their limit of utilization they are quickly replaced, at a very nominal cost.

Davis Expansion Boring Tools have created and are maintaining a reputation for merit and efficiency that entitles them to the position of unquestioned superiority.

Production Engineers, Equipment Engineers, Efficiency Engineers—all solve their metal boring problems with the use of Davis Expansion Boring Tools.

The many advantages and features these tools possess are readily recognized as essential to rapid, accurate and economical boring production. A saving of 25% or more in costs—this is your own guarantee of their efficiency and merit.

Give your operators an opportunity to produce the utmost by equipping their machines with Davis Expansion Boring Tools. Results will show in maximum production, greatest efficiency and lowered costs.

Remember—Davis Expansion Boring Tools will positively increase your boring production. Let us tell you just how it can be done.

DAVIS BORING TOOL COMPANY

Incorporated

FOREST PARK BOULEVARD AT SPRING AVENUE, ST. LOUIS, MO., U. S. A.

Largest Exclusive Manufacturers of Expansion Boring Tools and Expansion Reamers

Geometric Efficiency

"HOW are you on Geometric Screw-cutting Tools here?" asked a Service Man of a Shop Foreman. "We are 100 per cent. Geometric," was the reply. That means 100 per cent. efficient on Screw Thread Production. We would like to have you form the habit of consulting us when there is any Screw Cutting Operation to be considered. There may be some slight suggestion that we can make which will mean much to you.

In tapping cored holes in castings it is usually preferable to ream the hole before the operation of tapping. For doing this, Geometric Collapsing Taps are fitted for the combination of reaming and tapping.

Where the hole is not deep enough to allow for the reamer in addition to the depth of the tapping, the reamer blades are placed between the chasers, as shown in Fig. 1 on opposite page.

Should the hole run through the piece, or be deep enough to accommodate the reamer, it is placed on the end of the Tap ahead of the chasers, and is known as the rose reamer. Reamers of this type are made solid up to 3-inch diameter. See Fig. 2. Above 3-inch diameter, they are the adjustable blade type. See Fig. 3.

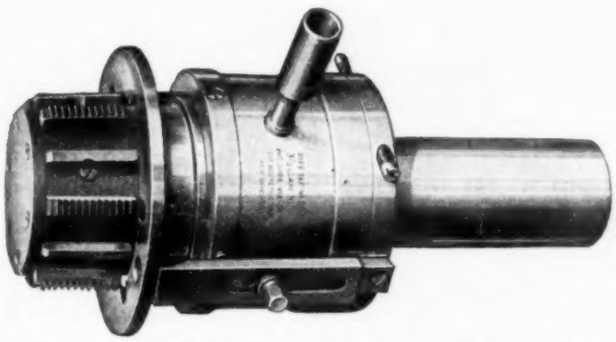
There must be some way in which we can be of service to you in your screw cutting. It will place you under no obligation to ask us about it.

The Geometric Tool Company,

Chicago Office:

GEO MET RIC

Right in the Lead



Combination Geometric Collapsing Pipe Taps and Reamers

Fig. 1. Class "NL" Tap with Inserted Reamer Blades

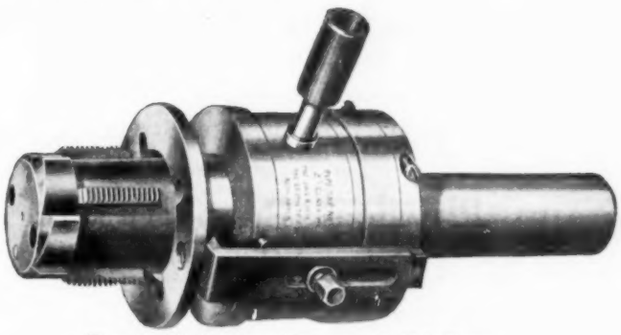


Fig. 2. With Rose Reamer, Solid Type

Reaming and Tapping in One Operation

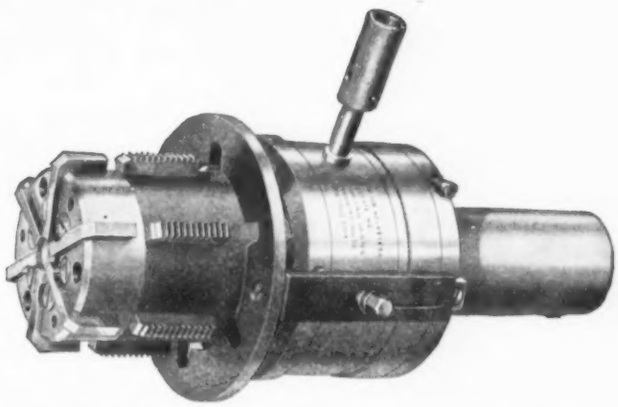


Fig. 3. With Rose Reamer—Adjustable Blade Type

New Haven, Connecticut

627 W. Washington Blvd.

DURALUMIN

DURALUMIN is an alloy produced after years of systematic endeavor to meet the demand for a metal which shall be as light as aluminum and as strong as mild steel, yet without the many disadvantages of aluminum in its pure state.

Duralumin is the only light metal that can replace steel in forgings. With a two-thirds saving in weight, heat treated Duralumin Forgings approximate mild steel forgings in strength. Wherever weight is a deciding factor, Duralumin is the most satisfactory metal for most articles made by hot working or forging. Naturally, Duralumin Forgings are especially desirable for reciprocating or moving parts where inertia, due to their own weight, forms a large part of the total stress.

Minimum Physical Properties of Rolled or Sheet Metal (heat treated) and of Forging Metal are

Tensile .....55,000 lbs. per sq. inch
Elastic Limit .....30,000 " " " "
Elongation 18%

Baush Machine Tool Company

Metals Division

Springfield, Mass., U. S. A.

Manufacturers of

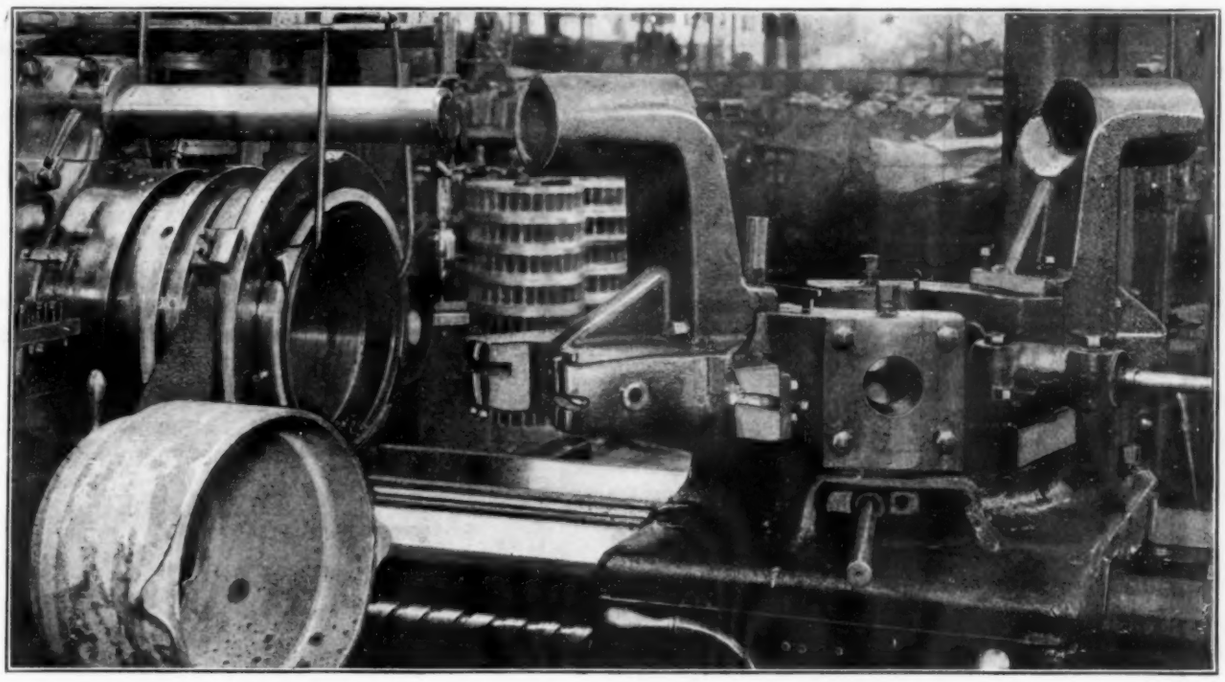
DURALUMIN

BLOOMS SLABS BILLETS SHEETS
FORGINGS

BAUSH CASTING-METAL INGOTS
Aluminum Alloy of High Tensile Strength

Rolling Mill and Drop Forge Works
SPRINGFIELD, MASS.

Detroit Office
1825 Dime Savings Bank Bldg.



Machining Delco Generator Frames

The photograph above shows a tool set-up on a Steinle 24-in. Turret Lathe for turning out Delco Generator Frames at the plant of the Delco Light Company of Dayton, Ohio.

The chucking fixture revolves in a steady rest and is equipped with centering and stop pins for centering and locating rear end of frame by pulling sleeve collar forward. Set screws hold the front end in place. The turret fixture is reinforced in the machining operation by the overhead bar support; thus preventing undue chatter or jar under the heavy cuts taken.

This is only one of a number of installations in plants manufacturing electrical equipment where the Steinle is called upon to produce various parts from castings, forgings or bar stock.

In view of present manufacturing conditions it is invariably performance that counts and the Steinle qualities of accuracy, speed, ease of operation, power, reliability and economy of upkeep are guarantees of satisfactory performance on your own work.

Material—Cast Steel

Finish—Bore, Counterbore, Face Bottom, Face Lugs

Time—25 Minutes Each

Why not send us your blueprints if your requirements call for the installation of equipment of this character? We shall be glad to furnish you with production and tooling estimates, or to have a qualified representative call and take up the question of Steinle methods as applied to your production problems.

STEINLE TURRET MACHINE CO.

Originators of the full swing side carriage turret lathe

MADISON, WIS., U. S. A.

AGENTS—Machine Tool Engineering Company, Singer Building, New York City; Cadillac Tool Company, Dodge Power Building, Detroit, Michigan; L. G. Henes, 75 Fremont Street, San Francisco, California, and Title Insurance Building, Los Angeles, California. FOREIGN—Leo C. Steinle, 53 Victoria Street, London, England.

MAXWELL
MANNING M&M MOORE INC.
TRADE MARK

SERVICE

during 1921

Machine Tools
Cranes
General Supplies

A salesman or engineer is always ready at your call to give advice and information regarding operation, service and production.

Communicate with our nearest Branch Office

Factories:

Shaw Crane Works, Muskegon
Putnam Machine Co., Fitchburg
The Ashcroft Mfg. Co., Bridgeport
The Consolidated Safety Valve Co., Bridgeport
The Hancock Inspirator Co., Boston
The Hayden & Derby Mfg. Co., Boston

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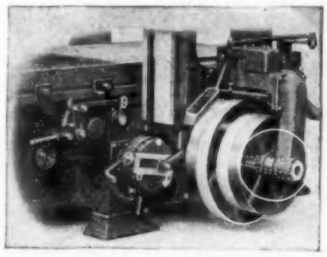
CINCINNATI

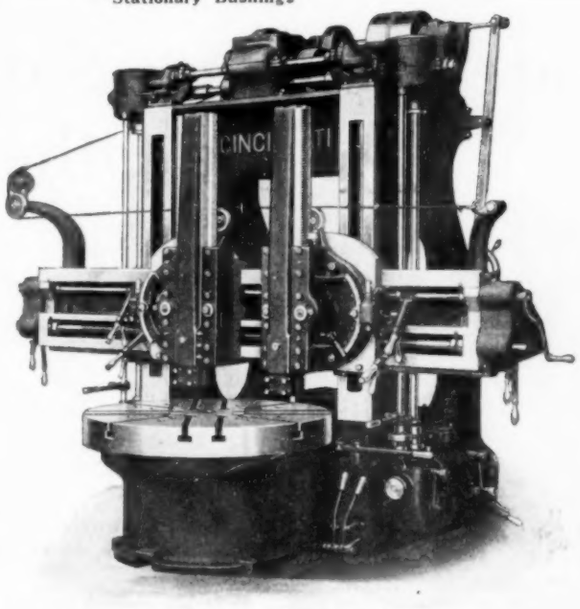
PLANERS *Original Thru out* BORING MILLS

Sustained

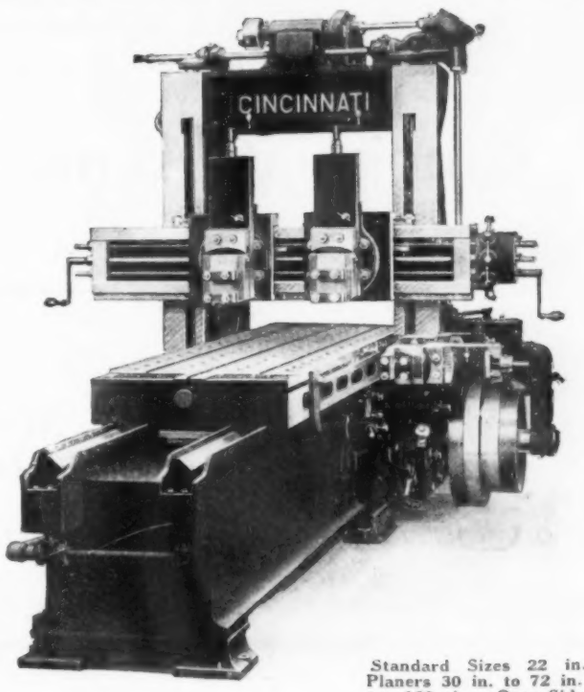
merit is to nourish—to strengthen—to maintain—to keep constantly improving the thing you are doing. Persistent effort has enabled CINCINNATI Planers with Rapid Power Traverse, Forced Lubrication, Herringbone Gears, Box Table and Box Arch to create a new Era in Planer Design, Operation and Production.



Loose Pulleys Revolve on Stationary Bushings



Sizes 42 in. to 12 ft.



Standard Sizes 22 in. Planers 30 in. to 72 in. to 120 in. Open-Side

Merit

to be sustained must show evidence of continuity of purpose. "CINCINNATI" Mills openly bear this mark of distinction.

Rapid Power Traverse, Selective Speeds, Quick Change Feeds and Centralized Control enable them to continue the purpose for which they have been designed in a manner never before attained.

Catalog with complete details promptly forwarded

THE CINCINNATI PLANER CO., Cincinnati, Ohio, U. S. A.

AGENTS:

Domestic: Henry Prentiss & Co., Inc., New York, Hartford, Boston, Buffalo, Syracuse, Rochester; Motch & Merryweather Mchry. Co., Cleveland, Detroit, Pittsburgh, Cincinnati; Marshall & Huschart Mchry. Co., Chicago, Indianapolis; Elliott & Stephens Mchry. Co., St. Louis; W. E. Shipley Mchry. Co., Philadelphia; Kemp Mchry. Co., Baltimore; Dewstoe Machine Tool Co., Birmingham; Seeger Mach. Tool Co., Atlanta; C. T. Patterson Co., Ltd., New Orleans; Eccles & Smith Co., San Francisco and Los Angeles; Zimmerman, Wells Brown Co., Portland; Hallidie Mchry. Co., Seattle; Union Iron Works Co., Spokane; Salt Lake Hardware Co., Salt Lake City; Hendrie & Bolthoff Mfg. & Sup. Co., Denver; Robinson, Cary & Sands Co., St. Paul and Duluth. **Canadian:** Rudel-Belnap Mchry. Co., Toronto and Montreal. **Foreign:** Aux Forges de Vulcain, Paris; Chas. Churchill & Co., London (Planers); Geo. H. Alexander Mchry., Ltd., Birmingham (Boring Mills); Ing. Ercole Vaghi, Milano; Hijo de Miguel Mateu, Barcelona; J. Lambercier & Co., Geneva; Chr. A. Herstad, Copenhagen and Stockholm; Gustav Nielsen, A/S, Christiania; Ateliers Demoor, Brussels; Andrews & George Co., Tokyo; Benson Bros, Co., Ltd., Sydney; Wilh. Sonesson & Co., Ltd., Malmo (Boring Mills); Aktiebolaget E. Gronblom, Abo.

We extend our Best Wishes for a

Happy and Prosperous New Year

and pledge ourselves during 1921 *to continue the inherent quality of*

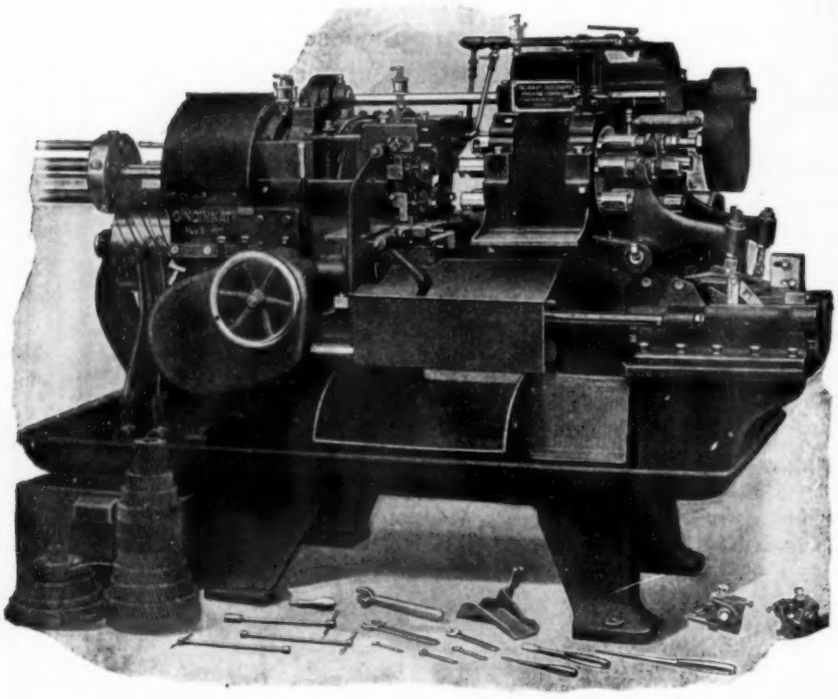
Cincinnati Acme Turret Machinery

The ACME Machine Tool Co.

Cincinnati, Ohio, U. S. A.

Flat Turret Lathes *Screw Machines* *Turret Lathes*

Just As Easy to Operate From One Side As the Other



The Cincinnati Five Spindle Automatic Screw Machine has a constant speed hand wheel and starting and stopping lever on each side.

It can run without chucking or feeding. The stock feeds against stop. Nine tools can be operating together. Each tool has its own cam. No designing of special cams necessary. Index plates on machine make books and reference tables unnecessary.

All tools positively withdrawn from work. Feed driven by friction clutch, as a safety. Change gears give fourteen changes of spindle speeds.

Complete description and all details given in our Screw Machine Bulletin. Write for a copy.

Cincinnati Automatic Machine Co.

Cincinnati, Ohio, U. S. A.

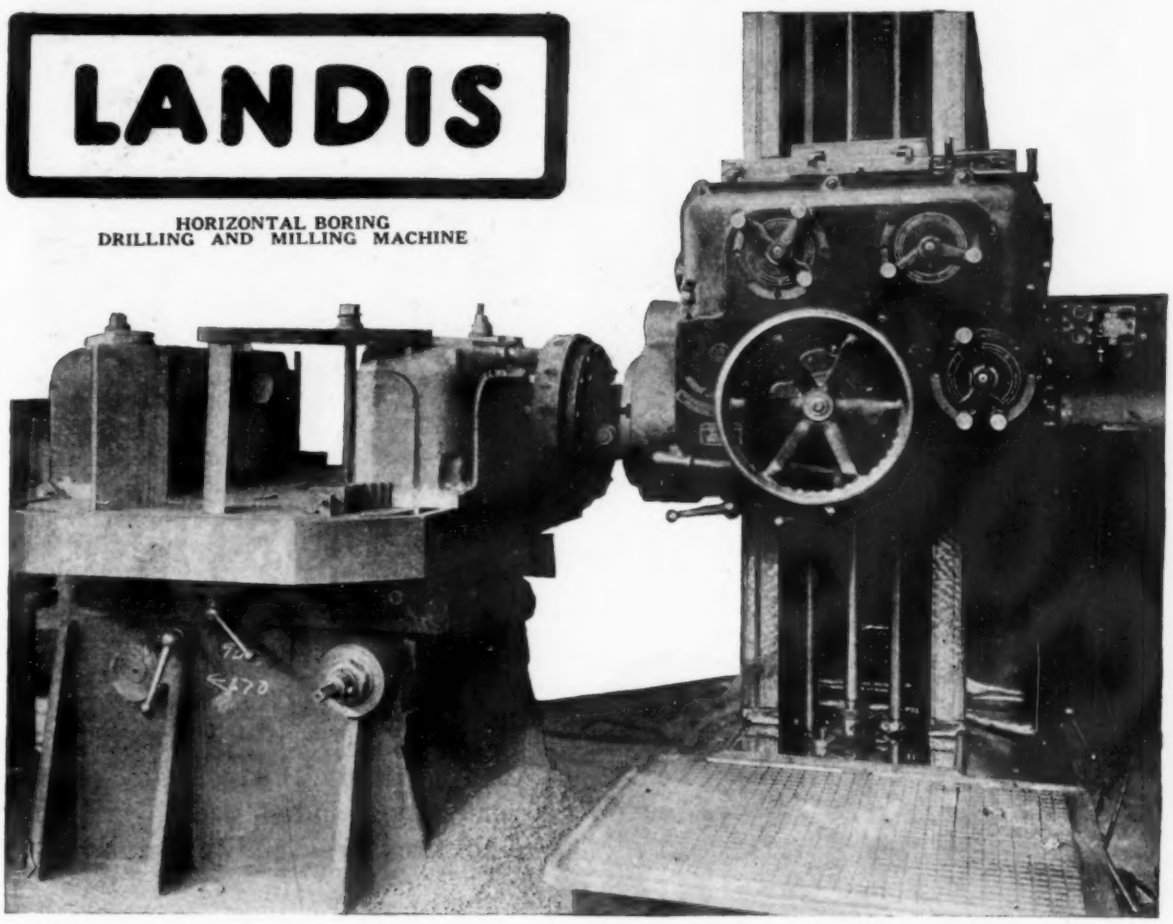
Manufacturers of

Multiple Spindle Automatic Screw Machines and Multiple Spindle Automatic Drills

CONTINUOUS MILLING

LANDIS

HORIZONTAL BORING
DRILLING AND MILLING MACHINE



The illustration shows a Landis No. 40 Boring Machine, operating on castings, bolted to the standard swivel table.

A continuous milling operation is obtained by setting up one piece on the opposite side of the table while the first casting is being milled. After finishing this piece, the table is rotated, bringing the other part in position for the milling operation.

On smaller castings, four pieces can be bolted to the table at one time, rotating one-quarter of a revolution for each milling operation.

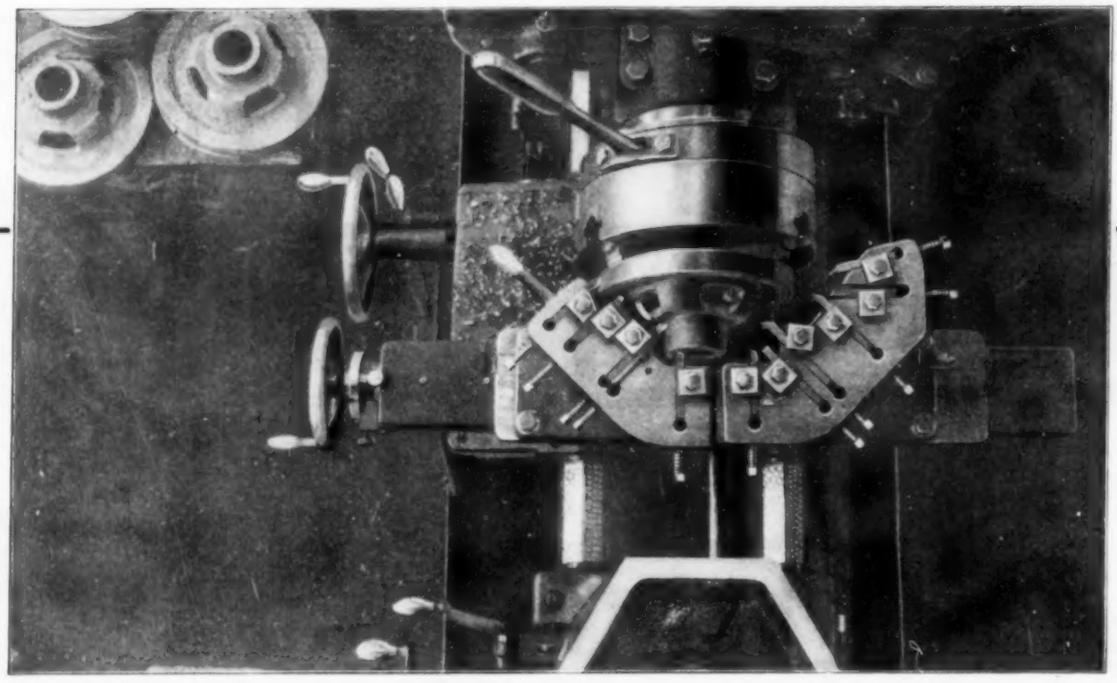
You have similar castings in your factory that should be machined on a Landis Horizontal Boring Machine.

Send for Catalog

LANDIS TOOL CO. Waynesboro, Pa.

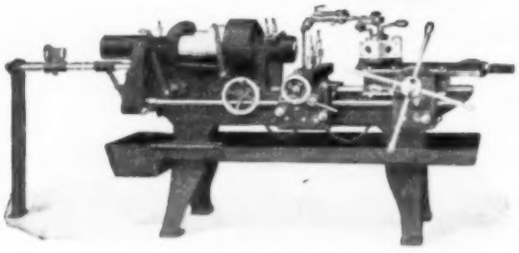
New York Office: 50 Church St.

DOMESTIC AGENTS: Dewstoe Machine Tool Co., Birmingham; Elliott & Stephens Machinery Co., St. Louis; Hallidie Machinery Co., Seattle; Harron, Rickard & McCone, San Francisco and Los Angeles; Hendrie & Bolthoff Manufacturing & Supply Co., Denver; Seegen Machine Tool Co., Atlanta; Sheehan-North Co., El Paso. **CANADIAN AGENTS:** A. R. Williams Machinery Co., Toronto; Williams & Wilson, Ltd., Montreal. **FOREIGN AGENTS:** Allied Machinery Co., Paris, Turin, Barcelona, Brussels, Zurich and Lisbon; Andersen, Meyer & Co., Ltd.; Shanghai; Andrews & George Co., Ltd., Tokyo; Benson Brothers, Sydney and Melbourne; Burton Griffiths & Co., Ltd., London; Wilh. Sonesson & Co., Malmo and Copenhagen.

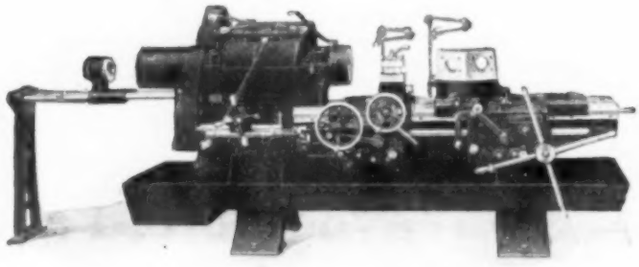


W. A. Barker Wrenchless Chuck

Every moment and movement productive



Foster Screw Machines—5 Sizes



Foster Universal Turret Lathes—3 Sizes

FOSTER

Engineering Skill—Your Asset

Above all else the real value of an organization, individual or machine is measured by its ability to do things.

The Foster Engineering Staff has successfully carried through one of the largest and most comprehensive engineering programs ever undertaken by any machine tool builder—the designing and perfecting of the largest, best and most up-to-date line of Screw Machine and Turret Lathes on the market today. This bespeaks their ability.

This same Engineering Staff stands ready to serve you, to solve your problems in tooling and production.

Send them your blueprints and take advantage of their skill and services.

FOSTER MACHINE CO., ELKHART, IND.

THERE is no surer way to obtain economy in grinding than by adopting Bryant Grinders. Both in quantity and quality of the work ground these machines have an unbeaten record.

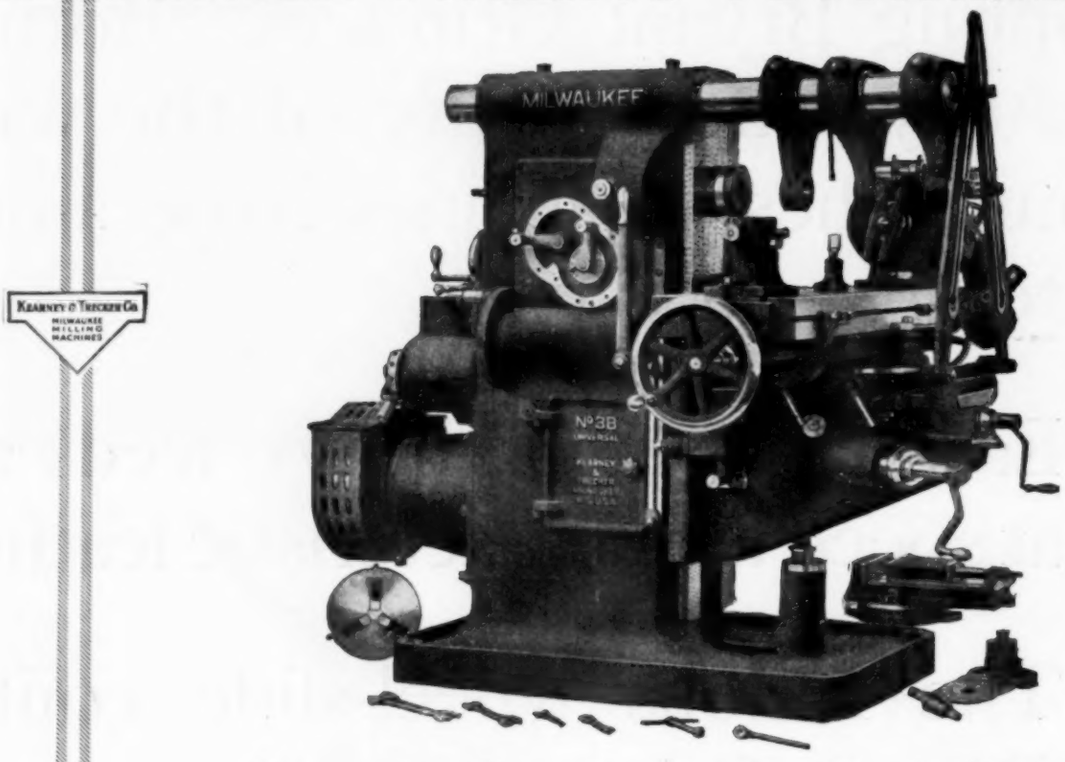
Ease of control, heavy feeds and great speed are characteristic features.

The famous wheel-slide control on Bryant Grinders is the principal reason for the advantages in output that these machines give. If you are interested in greater economy in grinding, it will pay you to investigate Bryant machines.

THE BRYANT CHUCKING GRINDER COMPANY
Springfield, Vermont

Hole Grinders Deep Hole Grinders Hole and Face Grinders

MILWAUKEE MILLING MACHINES



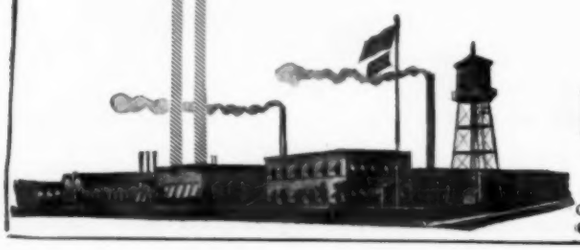
Superior Service in the Tool-Room

MILWAUKEE Universal Milling Machines are accurate, rigid and flexible and are distinguished for their efficiency on all kinds of milling done in the tool-room. Light or heavy operations are as one to the "Milwaukee."

A really scientific construction with all parts of the machine properly proportioned so as to form practically a single unit; features to reduce supervision, maximize ease of operation and increase the accuracy, rigidity and entire efficiency of the machines, make Milwaukee Universal Milling Machines the choice for the tool-room.

Firms that seek the certainty of tool-room satisfaction under all conditions find their hopes realized in the "Milwaukee."

Write for catalog—NOW.



KEARNEY & TRECKER CO.
MILWAUKEE, WIS., U.S.A.

CHICAGO OFFICE 631 WASHINGTON BLVD. NEW YORK OFFICE 1801 SINGER BLDG. CLEVELAND OFFICE 738 SUPERIOR AVENUE, N.W.

When a Prominent Manufacturer

TRADE T-P MARK

adopts a special tool, it is admitted that he may be saving money and time in his manufacturing processes.

When most of the prominent manufacturers

adopt and use Martell Reamers—such a consensus of opinion is unequivocal proof of their economy and efficiency.

Martell Machine Reamer

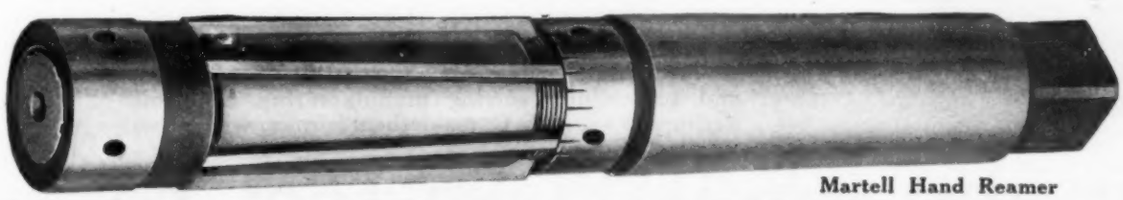
Martell Reaming System

is used by Packard, Locomobile, Chandler, Oldsmobile, Lincoln, White and other automotive manufacturers—effecting a considerable saving in bearing, fitting and finishing time—as well as producing equal if not better results than by hand.

The Martell Reaming System also includes adjustable reamers for use on machine tools (for reaming and finishing dead end holes to size) as well as adjustable hand reamers for reaming connecting rod bearings, and reaming accurate holes in machinery for studs, bolts or pins.

T. P. Bulletin 101A fully describes Martell Reaming System. Ask for a copy.

Martell Alignment Reamer



Martell Hand Reamer

THE TAFT-PEIRCE MFG. COMPANY

WOONSOCKET T-P RHODE ISLAND. U.S.A.

Trade Mark

2126

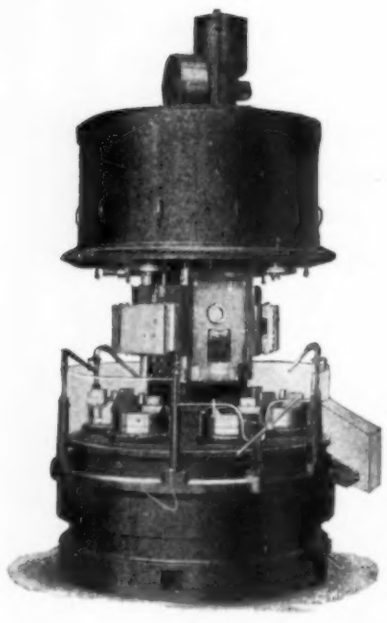
New York—Woolworth Building Chicago—First National Bank Building Detroit—Majestic Building

TAFT-PEIRCE PRODUCTS CARRIED IN STOCK BY: Syracuse Supply Co., Syracuse, Buffalo, Rochester; Cadillac Tool Co., Detroit; Sherritt & Stoer Co., Philadelphia; Wm. M. Pattison Supply Co., Cleveland; Northern Machinery Co., Minneapolis; Mid-West Machine & Tool Supply Co., Davenport, Iowa.

BULLARDIZE
YOUR PRODUCTION

The New Year Under New Conditions

MULT-AU-MATIC
MORE THAN A MACHINE
A MANUFACTURING METHOD



The cry of yesterday —"Output at Any Cost"— has been stilled. We are gradually, but surely, trending to normal.

Output is needed — will be needed in a gradually rising scale — but producing costs will be the prime consideration.

The power eating, slow moving, inefficient machine tool must step down and the machine that will produce at lower cost per unit take its place.

The Bullard Mult-Au-Matic readily takes the place of from 6 to 12 ordinary machines.

Its single operator merely chucks the rough parts and removes them in their finished state at the loading station. The machine is full automatic in action — all tool movements being mechanically controlled.

Machining error is practically unknown and transfer time is entirely eliminated.

To **Bullardize** is to produce under new and normal conditions. Have you thought about it?

Bullard Service Engineers have the faculty of quickly and successfully solving manufacturing problems. Perhaps it will help to make them familiar with yours.

THE BULLARD MACHINE TOOL CO.
Bridgeport, Conn.

FORGINGS
up to
capacity of 3500 lb. Steam Hammer.

BAR STOCK PARTS
up to
$3\frac{3}{4}$ inch machine capacity.

GRAY IRON CASTINGS
up to
10 tons in weight.

Bullard Products Division

In connection with our new plant at Bridgeport, Conn., we have established a modern Products Division.

It is complete to the last detail and includes Pattern Shop, Foundry, Forge Shop, Heat Treating Department and a Machine Shop having few equals in variety and quality of equipment.

To manufacturers having work in insufficient quantities to justify the purchase and installation of modern equipment, or who have not yet equipped a plant, the Bullard Products Division offers the greatest advantages.

Work of This Nature is Solicited

MULT-AU-MATICS
up to
16 inch capacity.

VERTICAL TURRET LATHES
up to
54 inch capacity.

MAXI-MILLS
up to
72 inch capacity.

Address—
Products Division

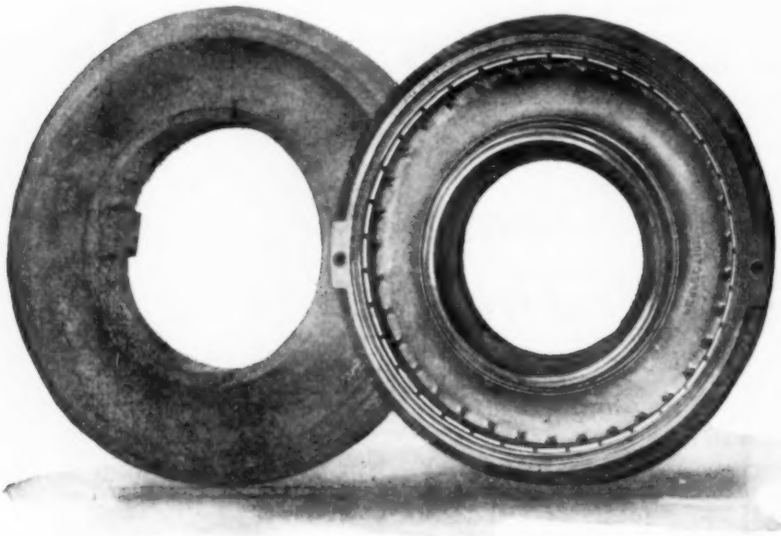
THE BULLARD MACHINE TOOL CO.
Bridgeport, Conn.

A Colburn Boring Mill in Action on Tire Molds

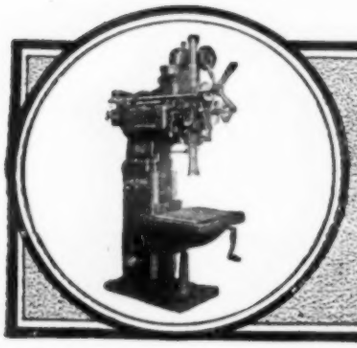
THEY are Perfection tire molds, 40 inches in diameter and are made of cast iron. A ¼-inch cut is taken by the Colburn and Mr. V. H. Hurt, foreman of the machine shop in the plant of the Perfection Tire and Rubber Co., Ft. Madison, Ia., has found that the rigidity of the Colburn is there in full measure.

If you are after the sort of production that puts prestige behind your products, as well as low machining costs behind the parts, you will find your answer in Colburn Boring and Turning Mills.

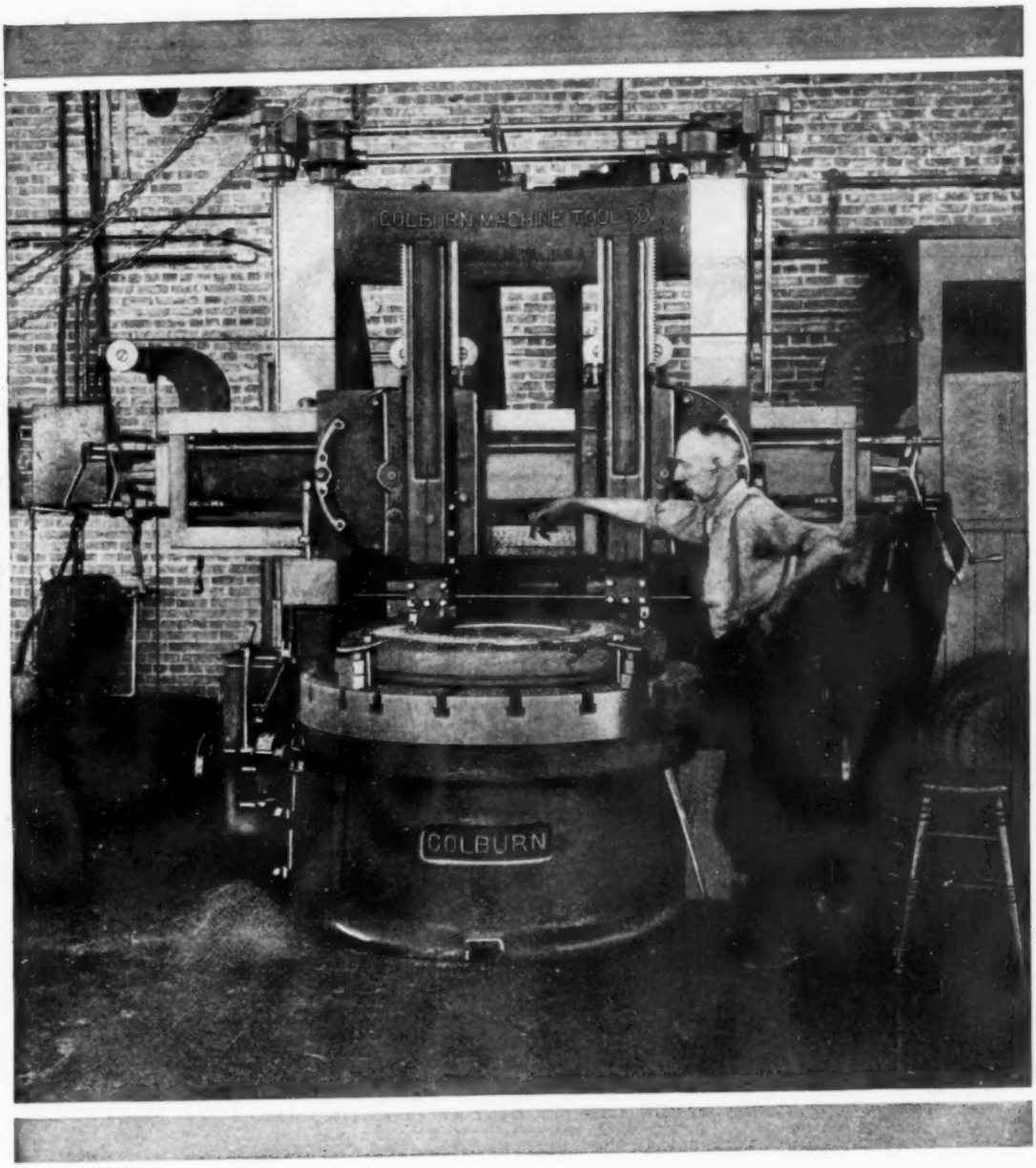
Shall We Send Bulletins?



DOMESTIC AGENTS: Strong, Carlisle & Hammond, Cleveland and Detroit; Brown & Zortman Mach. Co., Pittsburgh; Sherritt & Stoer Co., Philadelphia; Dale Machinery Co., Inc., New York and Chicago; Northern Machinery Co., Minneapolis and Duluth; Seifreat Woodruff Co., Cincinnati and Dayton, Ohio, Berger & Carter, San Francisco and Los Angeles, Cal.; Hallidie Machinery Co., Seattle, Wash.; Young & Vann Supply Co., Birmingham, Ala.; C. T. Patterson Mach. Co., New Orleans, La.; Ralph B. Bowman, St. Louis, Mo.; Mills & Lupton, Chattanooga, Tenn.; Fulton Supply Co., Atlanta, Ga.; Marshall & Huschart Machinery Co., (Drill Presses only), Indianapolis, Ind. CANADIAN AGENTS: H. W. Petrie, Toronto, Ont. FOREIGN AGENTS: Fenwick Freres, France, Switzerland, Italy; E. Isbecque & Co., Belgium; American Machinery Syndicate, Spain and Portugal; Charles Churchill & Co. (Boring Mills only), England; Alfred Herbert, Ltd. (Drill Presses only), England, Australia, Japan, India.



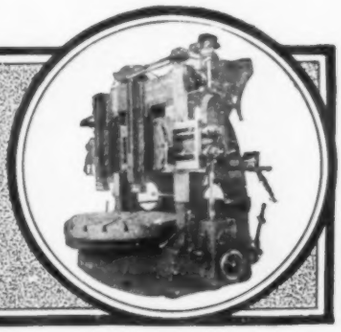
COLBURN



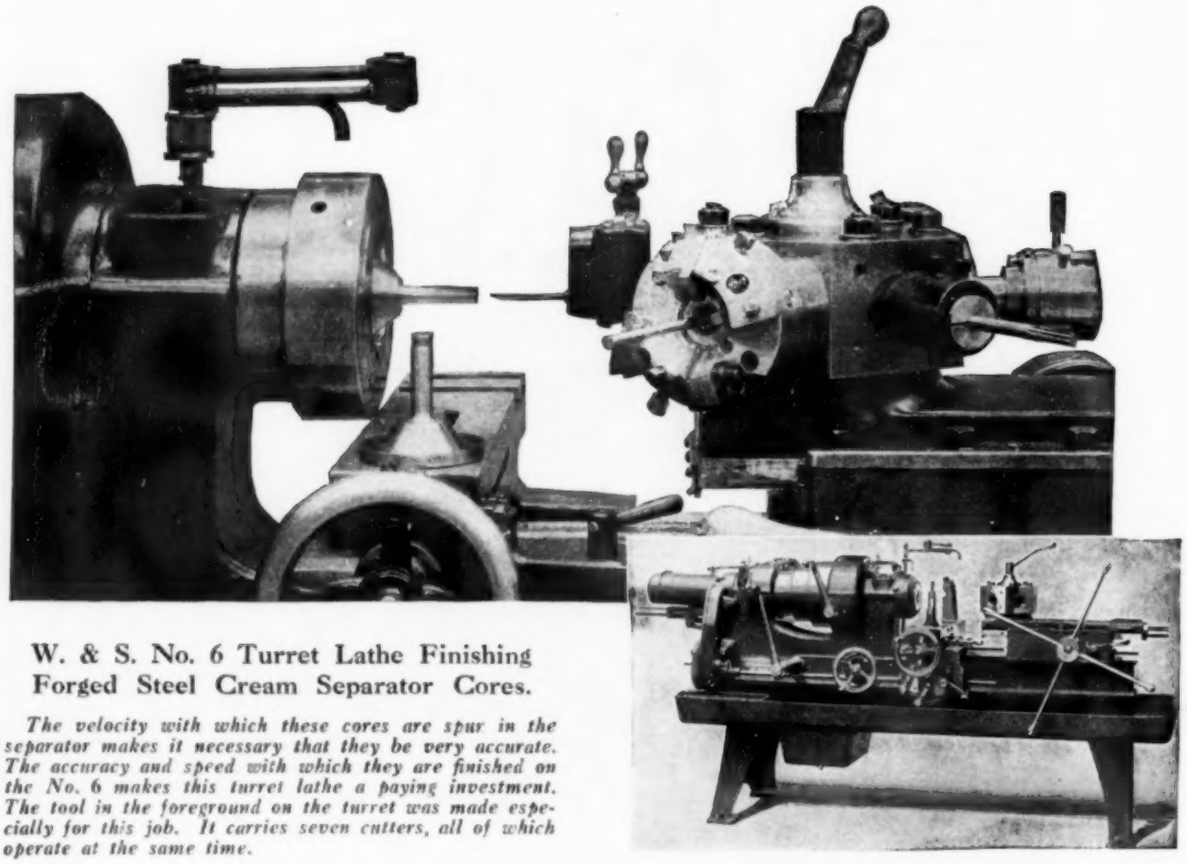
MACHINE TOOL COMPANY

CLEVELAND, OHIO. U.S.A.

Builders Also of Colburn Heavy Duty Drill Presses



Everyone C



W. & S. No. 6 Turret Lathe Finishing Forged Steel Cream Separator Cores.

The velocity with which these cores are spur in the separator makes it necessary that they be very accurate. The accuracy and speed with which they are finished on the No. 6 makes this turret lathe a paying investment. The tool in the foreground on the turret was made especially for this job. It carries seven cutters, all of which operate at the same time.

World's Largest Manufacturer of Turret Lathes and Turret Lathe Tools.

THE WARNER & SWASEY C

BRANCH SALES OFFICES

NEW YORK: Singer Building BOSTON: Oliver Building

BUFFALO: Iroquois Building DETROIT: Ford Building

DOMESTIC AGENTS—

Fulton Supply Company, Atlanta, Ga.
Young & Vann Supply Company, Birmingham, Ala.
Woodward, Wight & Company, New Orleans, La.
Salt Lake Hardware Company, Salt Lake City, Utah.
Smith-Booth-Usher Company, Los Angeles, Cal.
Fred Ward & Son, San Francisco, Cal.
Portland Machinery Company, Portland, Oregon.
Hallidie Machinery Company, Seattle, Wash.
Hendrie & Bolthoff Mfg. & Supply Company, Denver, Col.
Peden Iron & Steel Company, Houston, Texas.

CANADIAN AGENTS—

A. R. Williams Machinery Company, Ltd., Toronto, Winnipeg, Vancouver, St. John.
Williams & Wilson, Ltd., Montreal.

Considers Price

Of course everyone considers price. And a thing is expensive or not in proportion to its value to you.

When a machine is built in such a way that it delivers service to you year after year without ceasing, it's worth something.

When a machine is built in such a way that its accuracy lasts year after year, you want to know about it.

When this accurate-durable machine produces your work faster and better than any other machine on the market, your costs go down and you know your investment in that machine is a paying one.

Warner & Swasey Turret Lathes are built just that way. We'd be glad for a chance to prove it to you—Write us.

4½-in. x 44-in.—21-in. Swing to 5/8-in. x 4-in.—10-in. Swing.

COMPANY, Cleveland, U. S. A.

CHICAGO: 618-622 Washington Boulevard

MILWAUKEE: 209 Sycamore Building

INDIANAPOLIS: 940 Lemcke Annex.

DAYTON: 518 Mutual Home Building

FOREIGN AGENTS—

Charles Churchill & Company, Ltd., London, Birmingham, Manchester, Bristol, Newcastle-on-Tyne, Glasgow.
Allied Machinery Company, Paris, Turin, Zurich, Barcelona, Brussels
Wilhelm Sonesson Company, Malmo, Copenhagen, Stockholm, Gothenburg.

R. S. Stokvis en Zonen, Rotterdam.
Benson Brothers, Sydney, Melbourne, Adelaide.
Yamatake Company, Tokyo.
McLeod & Company, Calcutta.
Andersen, Meyer & Company, Ltd., Shanghai.
Brossard-Mopin & Company, Saigon, Singapore, Haiphong.

32-inch Stroke
Heavy Duty Back Geared

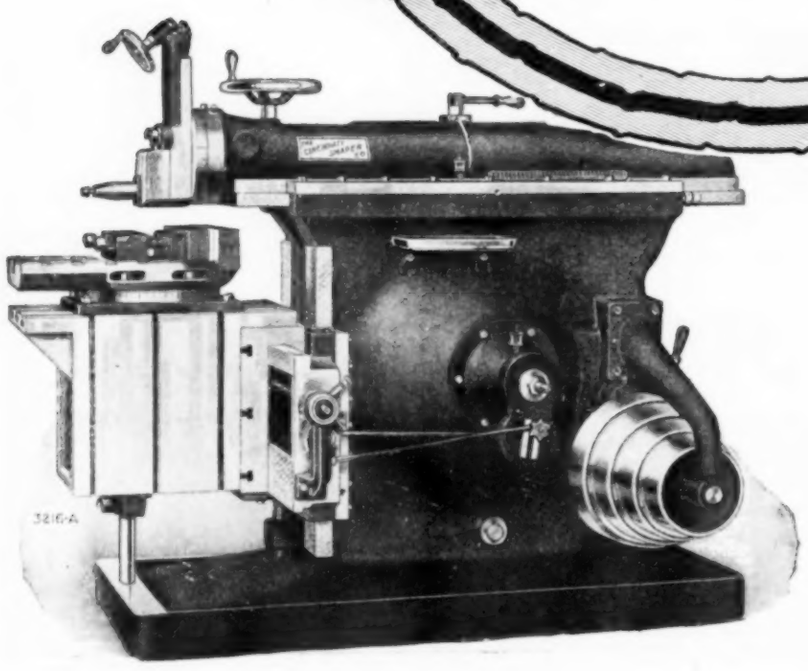
Cincinnati Shaper

The Railroad Shaper

One railroad recently ordered eight of these machines. Since they are so popular with the railroads we feel justified in calling the "Cincinnati" the railroad shaper.

We also manufacture Crank Shapers of other strokes, as well as Traverse Head Shapers and Crank Planers. Would you like our Bulletins?

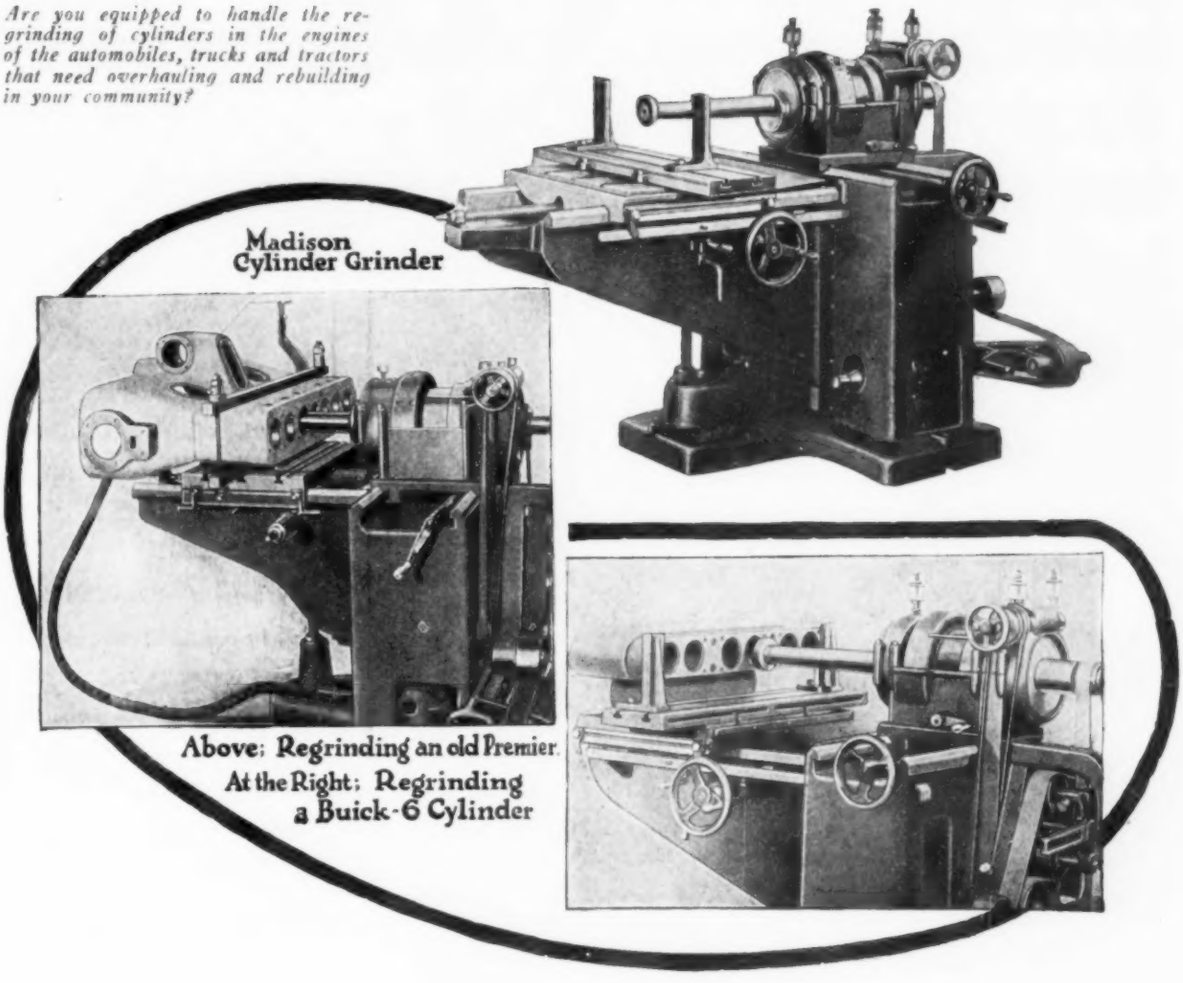
The Cincinnati Shaper Co.
Cincinnati, Ohio



Agents: Barbour, Love & Woodward, Inc., New York City; Cyril J. Bath & Company, Cleveland, Ohio; Monarch Machinery Company, Philadelphia, Pa.; Brown & Zortman Machinery Co., Pittsburgh, Pa.; Herberts Machinery & Supply Co., San Francisco and Los Angeles, Cal.; Hendrie & Bolthoff Mfg. Supply Co., Denver, Colo.; National Supply Company, Toledo, Ohio; C. T. Patterson Co., Ltd., New Orleans, La.; Wolverine Machinery & Supply Co., Detroit, Mich.; Stocker-Rumeley-Wachs Company, Chicago, Ill.; Williams & Wilson, Ltd., Montreal, P.Q., Canada.; H. W. Petrie, Ltd., Toronto, Ont., Canada; Hill, Clarke & Co., Inc., Boston, Mass.; Thomson Tool Supply Co., Indianapolis, Ind.; Mills & Lupton Supply Co., Chattanooga, Tenn.; Merritt Machinery Company, St. Louis, Mo.

Re-grinding Cylinders at a Profit

Are you equipped to handle the re-grinding of cylinders in the engines of the automobiles, trucks and tractors that need overhauling and rebuilding in your community?



Above: Regrinding an old Premier.
At the Right: Regrinding a Buick-6 Cylinder

Add the profit of cylinder grinding to your automobile repairing and not only increase your profits considerably but make your customers boosters for you by putting power and life into their cars.

Put a Madison Cylinder Grinding Machine to work for you and do the gas engine cylinder re-grinding for all the repair shops in your vicinity.

Ask for the circular describing this machine—it will be sent you by return mail.

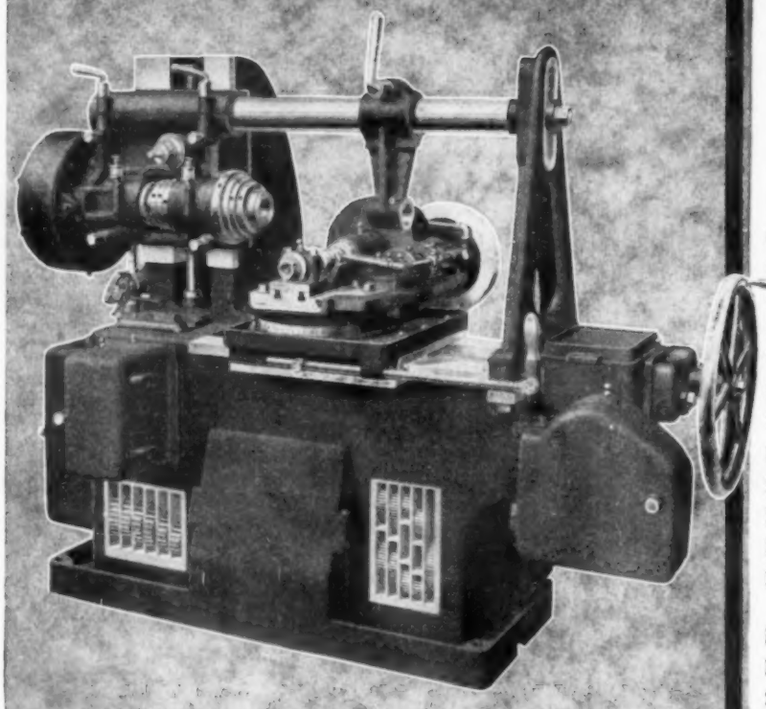
MADISON MACHINE TOOL COMPANY

1245 East Washington Avenue, Madison, Wisconsin, U. S. A.

BARBER-

HOBBING MACHINES

ACCURATE



A MANUFACTURING MACHINE FOR GENERATING SPUR AND SPIRAL GEARS

GENERAL SPECIFICATIONS

NO. 12

Capacity, diameter	12"
Capacity, width of face	10"
Capacity, diametral pitch, cast iron	3
Capacity, diametral pitch, steel	4
Diameter of hob mandrel	1¼"
Maximum diameter of hob	4"
Taper hole in spindle	No. 12 B&S
Driving Pulley	14" x 3¼"
Speed of driving pulley	300 to 400 R. P. M.
No changes of hob speed	8
Range of hob speed	45 to 220 R. P. M.
Range of feed of hob per rev. of work	015" to .150"
Floor Space	43" x 72"
Net Weight, approximately	4000 lbs.
Shipping Weight, approximately	4300 lbs.
Shipping Weight, Boxed for Export	4700 lbs.
Size of Export Shipping Case 48" x 63" 80"	140 cubic feet

BARBER-COLMAN COMPANY

HOME OFFICE & PLANT

ROCKFORD, ILL., U.S.A.

1920-920

COLMAN

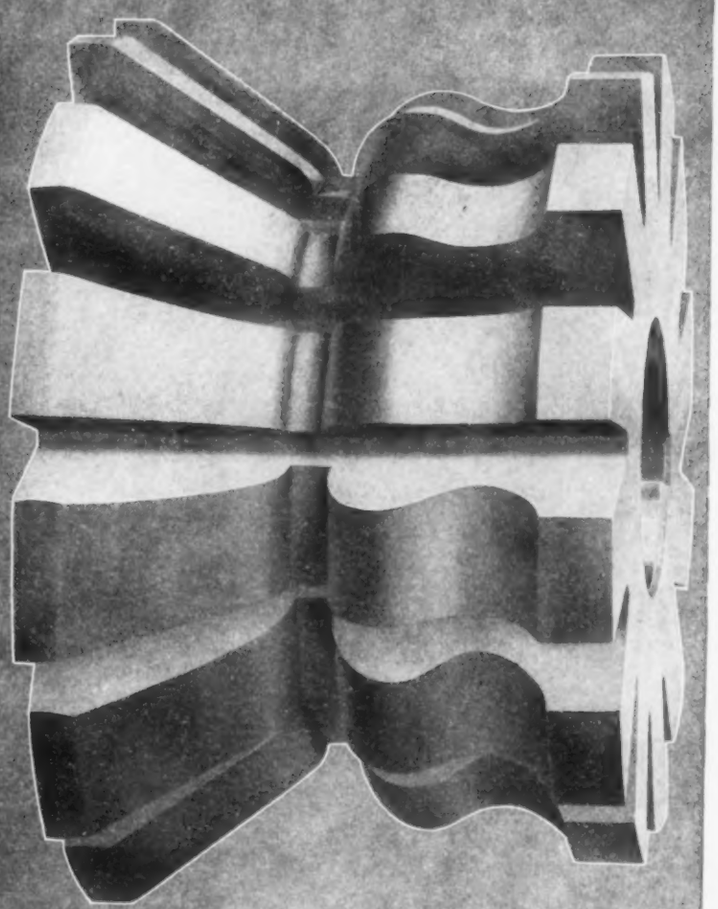
MILLING CUTTERS

DEPENDABLE

Our cutters are made from the highest quality of steel obtainable and our processes of manufacture are scientific and modern.

We have developed our formed cutter work until we are able to produce the most complicated forms with a high degree of accuracy.

Our engineering department will assist you in solving your cutter problems.



BRANCH OFFICES

BOSTON, MASS. BUFFALO, N.Y. CHICAGO, ILL. CLEVELAND, O.
DAYTON, O DETROIT, MICH. MILWAUKEE, WIS. NEW YORK CITY.

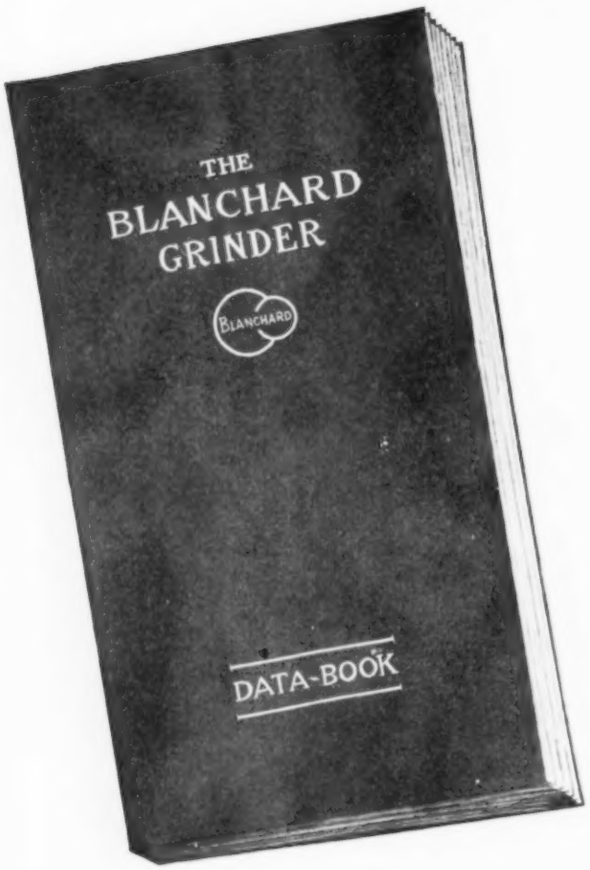
SPAIN
AMERICAN MCHY SYNDICATE
MADRID
BARCELONA

CONTINENTAL EUROPE
BARBER & COLMAN LTD.
MARSLAND ROAD BROOKLANDS
NEAR MANCHESTER
ENGLAND

BELGIUM
E. ISBECQUE & CO.
BRUSSELS
ANTWERP

920-9-A

Practise BLANCHARD Economy in your grinding during 1921



The Blanchard Data Book

gives the production figures on 50 typical grinding jobs.

These figures are a revelation to one not sufficiently familiar with the BLANCHARD GRINDER to realize its wonderful *cost-reducing* possibilities.

It gets down to brass tacks, gives you facts and figures and enables you to compare Blanchard Grinding with other methods.

Resolve that during 1921 you will economize wherever in your work it is possible to do so without affecting the quality of your product. Here is one opportunity.

Write today for this *Data Book* and make the comparison with figures obtained from other machines. This is the best suggestion we can give you for making 1921, as we hope it will be, a productive and prosperous New Year for you.

BLANCHARD

The Blanchard Machine Co.

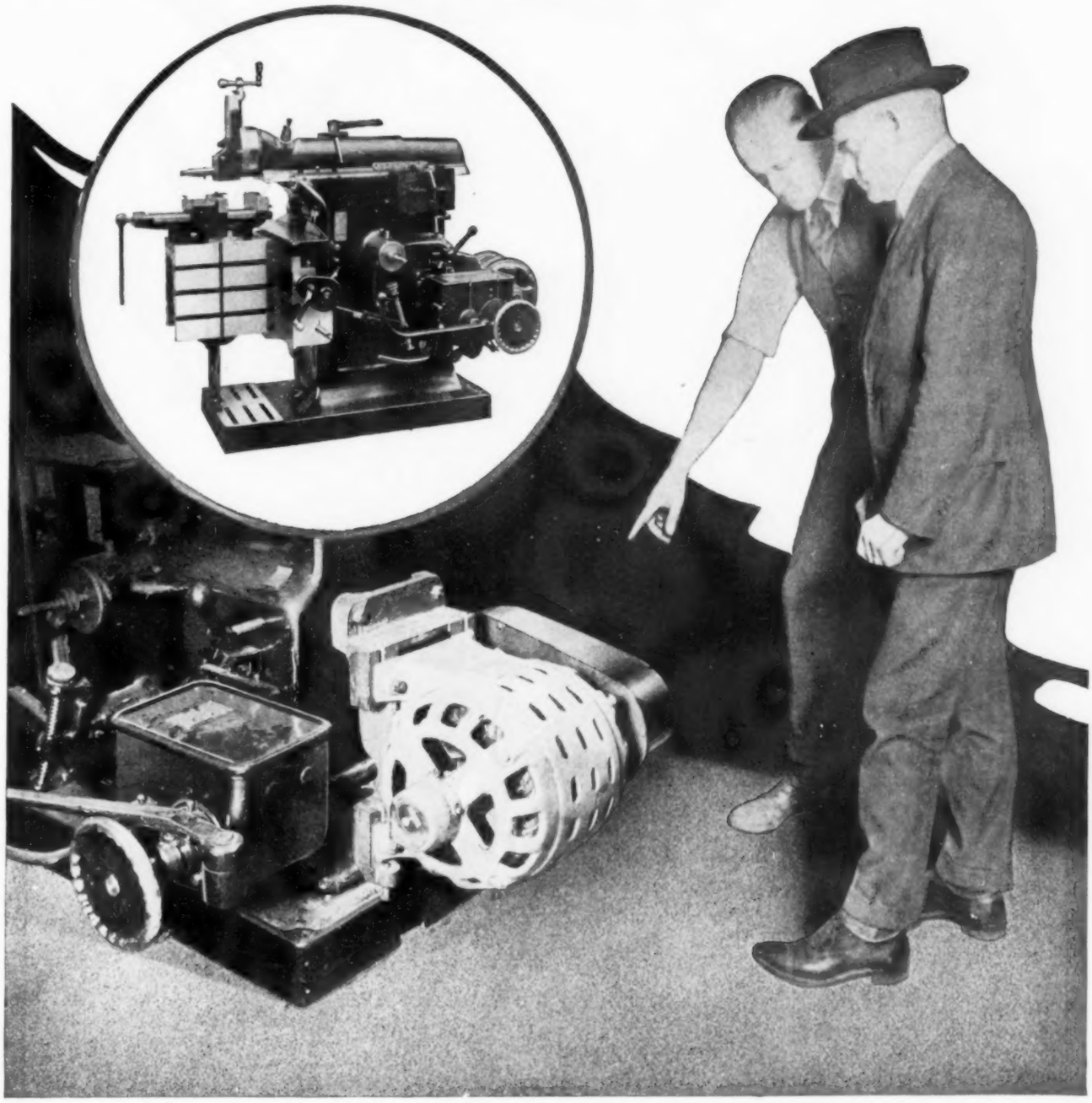
64 State Street, Cambridge, Mass., U. S. A.

UNITED STATES: Henry Prentiss & Co., Inc., Motch & Merryweather Co., Marshall & Huschart Machinery Co., W. E. Shipley Machinery Co., Kemp Machinery Co., Robinson, Cary & Sands Co., Pacific Tool & Supply Co.
CANADA: Williams & Wilson, Ltd., F. F. Barber Machinery Co.
GREAT BRITAIN: C. W. Burton, Griffiths & Co. FRANCE: Aux Forges de Vulcain. ITALY. SWITZERLAND. BELGIUM. SPAIN and PORTUGAL: Allied Machinery Co. of America. SWEDEN: A/B Rylander & Asplund.

Blanchard

High Power Vertical Surface Grinders

"ON G & E SHAPERS, see how easy it is to use a constant speed motor and change your speeds with gearbox."



GOULD & EBERHARDT

"HIGH DUTY" SHAPERS
AUTOMATIC GEAR AND RACK CUTTING MACHINERY

ESTABLISHED 1853 NEWARK, N.J. U.S.A.

Domestic Agents: Motch & Merryweather Machinery Co., Cleveland, Pittsburgh, Detroit and Cincinnati; Henry Prentiss & Co., New York, Boston, Buffalo, Syracuse, Rochester, Scranton, Hartford; Marshall & Huschart Machinery Co., Chicago and Milwaukee; Marshall & Huschart Machinery Co. of Indianapolis, Indianapolis, Ind.; Elliott & Stephens Machinery Co., St. Louis; W. E. Shipley Machinery Co., Philadelphia; Kemp Machinery Co., Baltimore and Richmond; Hallidie Machinery Co., Seattle; Dewstoe Machine Tool Co., Birmingham, Ala.; Seeger Machine Tool Co., Atlanta, Ga.; Robinson, Cary & Sands Co., St. Paul and Duluth, Minn.; Eccles & Smith Co., Los Angeles, San Francisco and Portland, Ore.; Salt Lake Hardware Co., Salt Lake City, Utah; Oliver H. Van Horn Co., Inc., New Orleans, La. **Foreign Agents:** C. W. Burton, Griffiths & Co., London, England; R. S. Stokvis & Zonen, Ltd., Rotterdam; R. S. Stokvis & Fils, S/A, Paris and Brussels; D. Drury and Company, Johannesburg, South Africa; A. R. Williams Machinery Co., Canada; Horne Co., Ltd., Tokyo, Japan; Lovell Tool & Machine Co., Havana, Cuba; Allied Machinery Co. of America, Switzerland, Italy, and China; Chr. A. Herstad, Copenhagen, Denmark; Pedro Martinto, Lima, Peru, South America. Hijo De Miguel Mateu, Spain. Edward J. Nell, Manila, Philippine Islands.

QUALITY and SERVICE

ARMSTRONG Drop Forged Steel Wrenches are made with the careful attention to every detail of design and manufacture which has given the name a special significance in the minds of Quality and Service buyers in every part of the world.

Specify Armstrong When Ordering and Get the Best

ALL KINDS—Prompt Delivery—ALL SIZES

Free Catalog mailed upon request

ARMSTRONG BROS. TOOL CO.
"THE TOOL HOLDER PEOPLE"
315 N. FRANCISCO AVE. CHICAGO, U.S.A.

Keeping Step with Father Time

ONLY THE BEST ARE GOOD ENOUGH
FILES TOOLS TRADE MARK

American Swiss Files

1899-1921

Since the date, over 20 years ago, when the founder of this organization resolved that high grade toolmakers' Files could be made in America as well as abroad, *American Swiss Files* have kept up with and ahead of the times.

Today there is no question that *American Swiss Files* display workmanship in cutting and spacing of their teeth as good as the best imported files—with the added advantage of greater uniformity as to temper and spacing.

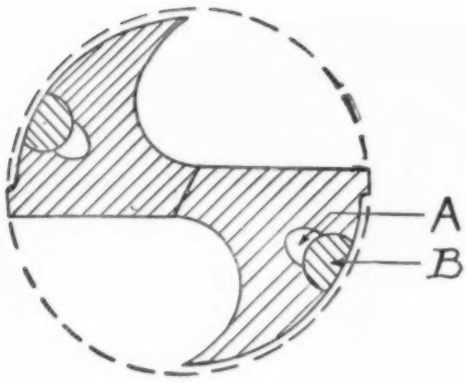
Each year finds America Swiss Files growing in favor with skilled mechanics—and with the beginning of the year 1921, their leadership is even more firmly established.

American Swiss File and Tool Company

E. P. Reichheim & Co., Sole Distributors

24 John Street, New York, N. Y.

Factory, Elizabeth, N. J.



Groove milled in blade of drill

Piece of drill-rod dovetailed into groove

LINCOLN

for Clean Holes, Quick Work, Less Drill Breakage

The Lincoln Oil Drill is radically different from ordinary oil drills.

The Lincoln puts the oil where the oil is needed—at the cutting edges.

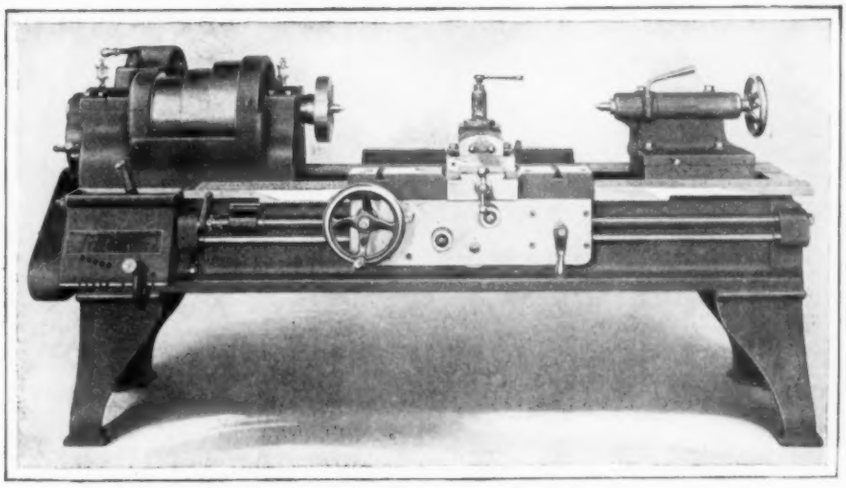
The illustration at the top shows how the Lincoln is made. A groove is milled in the blade of the drill and a piece of drill rod is dovetailed into the groove. For all practical purposes it is a solid oil drill. The old style drill with the inserted tube often gives trouble, as you know. The tube sometimes becomes loose and binds, or bends and breaks. If the tube is dented, even, the flow of the oil is interfered with. Such interruptions are costly.

To avoid them specify Lincoln Oil Drills.

LINCOLN TWIST DRILL CO.

TAUNTON, MASSACHUSETTS, U. S. A.

FLATHER



FLATHER 18 in. Double Back Geared Lathe

Simple and Practical

There are no fussy attachments or other complicated mechanisms to endanger speedy and accurate output on Flather Lathes. Yet they possess every feature for furthering close adjustment and operating ease.

We are constantly striving to improve and our efforts—according to users—are successful.

Flather Lathes cover the field. You will be interested in some one of them.

Flather & Co., Inc.
Nashua, N. H.

Little Wheels *for* Big Jobs

IT'S even more necessary to have the right wheels in the tool room than on any other grinding job.

Any old wheel won't do!

Drawing the temper and checking tools is a whole lot more expensive than getting the right wheel.

The proper wheel for your tool room work can be found in our complete stock of Aloxite Wheels.

For reamers, cutters and similar tools the condition is well met with 40 to 60 grit, M to N grade Aloxite wheels. For large, heavy tools we generally recommend 24 to 36 grit, H to I grade.

Let us give you just *the right wheel in the right place*—then standardize on—

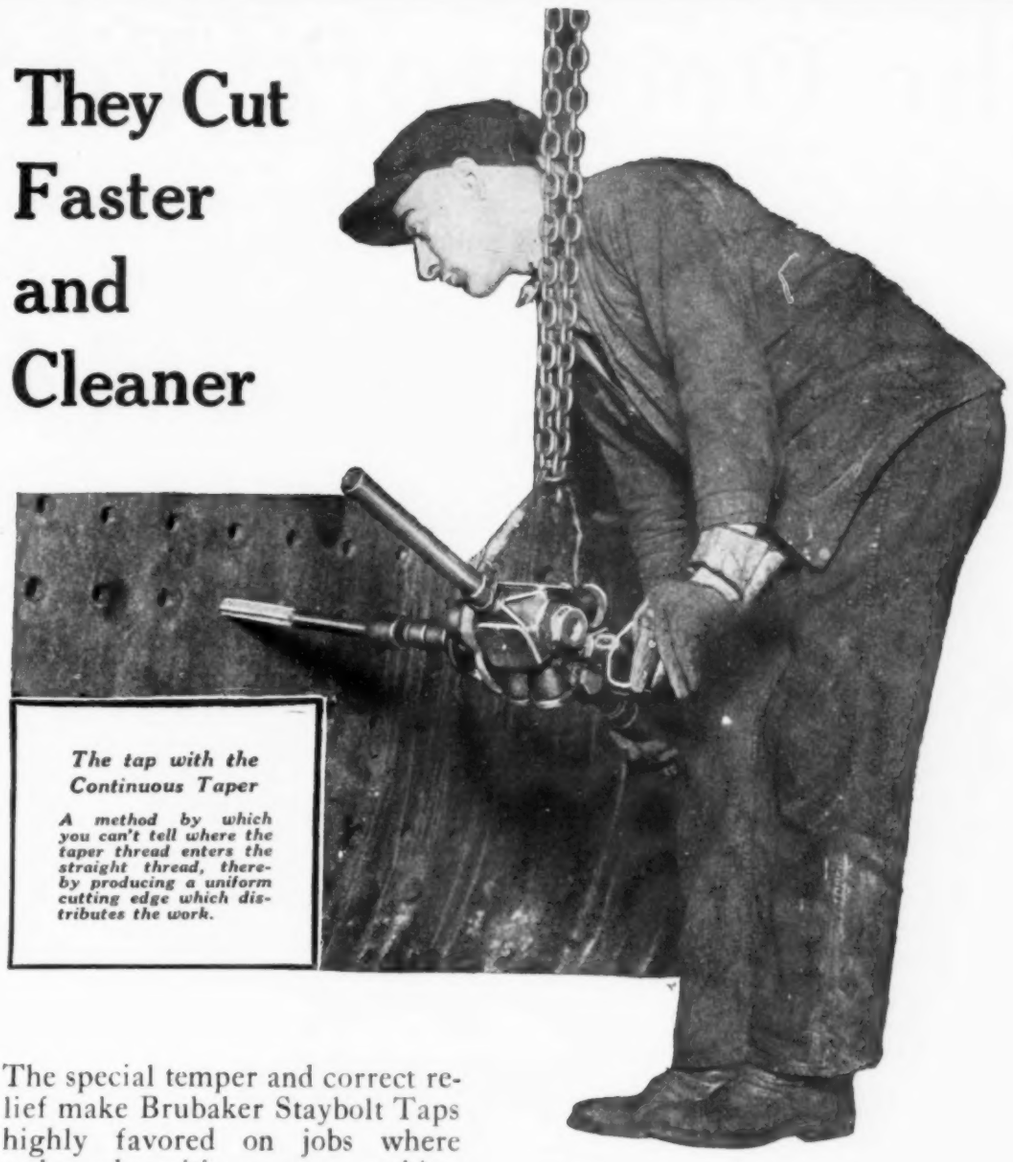
Aloxite in the Tool Room

The Carborundum Company

Niagara Falls N. Y.

New York Chicago Boston Detroit Cleveland
Philadelphia Pittsburgh Grand Rapids Milwaukee

They Cut Faster and Cleaner



The tap with the Continuous Taper

A method by which you can't tell where the taper thread enters the straight thread, thereby producing a uniform cutting edge which distributes the work.

The special temper and correct relief make Brubaker Staybolt Taps highly favored on jobs where awkward positions cause working strains.

They stand up under all conditions and meet the most severe demands. They cut easier and resist fracture under the highest motor speeds.

Brubaker Special Tempered Relieved Staybolt Taps will give you a full 20% more tapped holes per tap and every hole will be tapped alike.

If you take pride in output and have a leaning toward economy you cannot afford to choose the "just as good" tap—it must be a Brubaker. Ask for details.

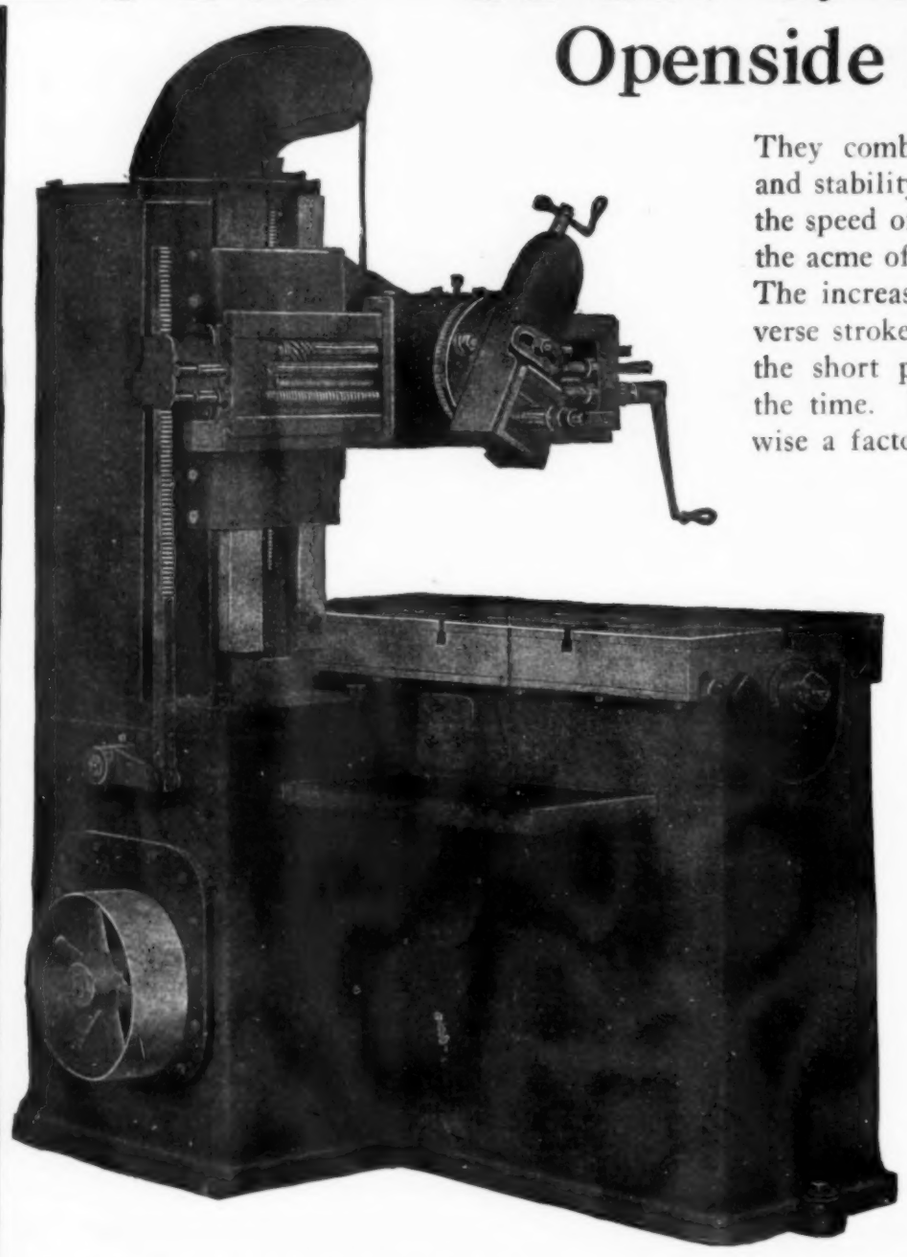
W.L.BRUBAKER & BROS.
50 Church St. New York

The Operator's Time

is entirely given to the machining of the piece in hand. There is no chasing about the machine to throw a lever here and turn a hand wheel there. This shows up big at the end of a day's run because a greater volume of output results. Centralized control, however, is but one feature of

LYND-FARQUHAR

Openside Planers



They combine the ruggedness and stability of the planer with the speed of the shaper and are the acme of accuracy in output. The increased speed of the reverse stroke aids in completing the short planing job in half the time. Floor space is likewise a factor.

Full details of this versatile planer are to be found in the Bulletin. Your request brings a copy by return mail.

LYND-FARQUHAR COMPANY, Boston, Mass.

Also Builders of Wall Radial Drills

Tools that GD&GD Go and Go

PERSONAL study of the special job coupled with attention to every detail from raw material to final inspection spells our success. Note the undercut of this heavy formed cutter which gives much freer cutting action to the tool and still maintains the correct shape on the work. Let us study **your** needs.

GODDARD & GODDARD COMPANY

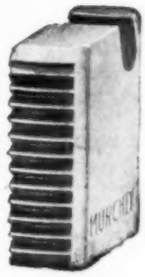
Designers and Manufacturers of Cutters for Milling Machines.

MILLING CUTTER ENGINEERS

DETROIT

A Happy New Year

and all the business you can handle



TO expeditiously and economically handle the threading jobs that are coming your way in 1921 you will need some of the 101 Standard Taps and Dies that bear the stamp of Murchey.

We say expeditiously and economically because every Murchey Tap is Collapsible or Adjustable and every Murchey Die is Self-Opening or Adjustable. Thus you are assured double speed minus the expense of scrapping the entire tool when the wearing parts become undersized.

Let us help you start the New Year right

Murchey Machine & Tool Co.

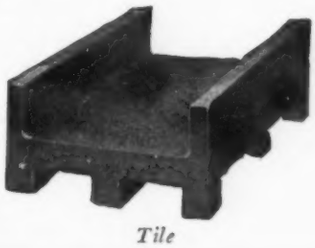
Detroit, Michigan

New York Office: 99 Warren St. Coats Machine Tool Co., 14 Palmer St., Westminster, London, S. W., England. Fenwick Freres & Co., Paris, France

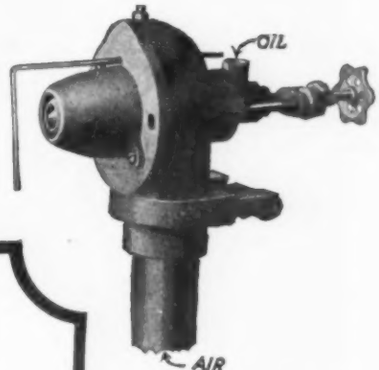
Murchey

The Strong, Carlisle & Hammond Company

Weintz Gas Burner



Tile



Type "W" Low Pressure Gas Burner

THE finest battery of heat-treating furnaces can be expensively handicapped by inferior accessories. That is why S-C-H engineers give such painstaking care to recommending and furnishing all the accessory items required by an efficient heat-treating department.

S-C-H engineers are not merely furnace engineers but are actually *heat-treating engineers.*

Inquiries covering accessories are given the same thorough attention as those in regard to furnaces.

The Strong, Carlisle & Hammond Company
Cleveland, Ohio

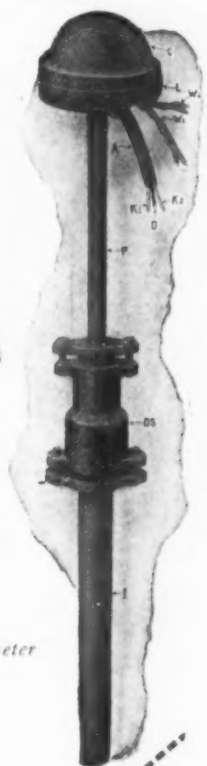
Branches:
BOSTON NEW YORK CHICAGO
PHILADELPHIA DETROIT

SCH INDUSTRIAL FURNACES

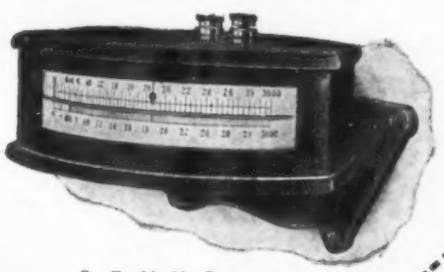
Oil Strainer

Manometer

Thermometer

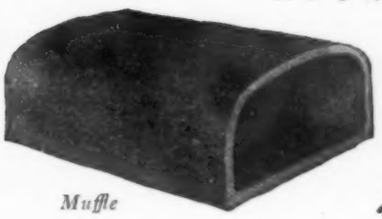


Pyod



S. C. & H. Pyrometer

Wire Dip Basket



Muffle

The Strong, Carlisle & Hammond Co.
Cleveland, Ohio

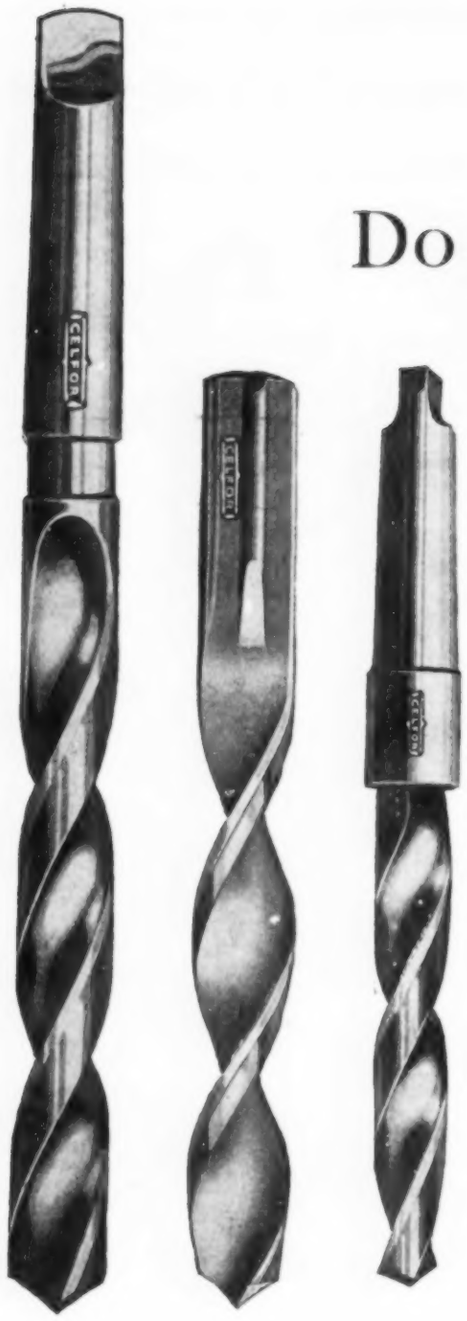
Please send description and prices on the following accessories:

.....

.....

.....

Signed .....



Do you realize that when you invest in *Drills*, you are really investing in *Holes?* ¶ And do you realize that a drill that will not make *Holes* is a Liability instead of an Asset? ¶ Celfor Drills make plenty of Holes.

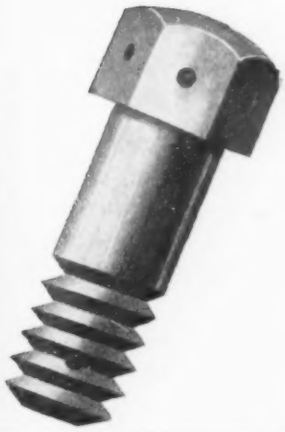
Clark Equipment Co.
Buchanan, Michigan

Celfor

HIGH SPEED TWIST DRILLS

From the Latin, "Celeritas," (speed) and "Fortis," (strength).

Foreign Representatives:
Montreal, Rudel-Belnap Machinery Co.; Toronto, Rudel-Belnap Machinery Co.; Amsterdam, U. S. Trading Corp.; Christiania, John M. Larsen; Copenhagen, John M. Larsen; Gothenberg, John M. Larsen; Stockholm, John M. Larsen; London, Coates Machine Tool Co.; Milan, Weiss & Stabilini; Tokio, Andrews & George; Paris, Moerch & Roumet.



SPEED?

it's up to the operator

Production on Detroit Semi-Automatic Drilling Machines is up to the operators ability to load and unload the simple holding fixtures.

It is an important factor in the automotive industries and its high standing in this field *proves* its economy.

You can appreciably cut down drilling costs by installing the Detroit. It has been tested, studied, perfected—and stands as the keynote in small hole drilling efficiency.

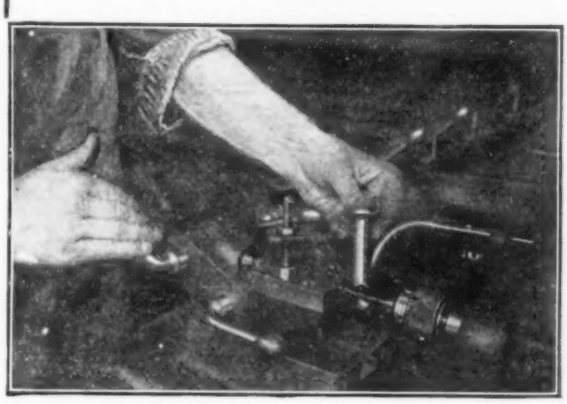
We stand ready to make time studies of your parts and quote production figures. We also design holding fixtures free of charge. Let us hear from you.

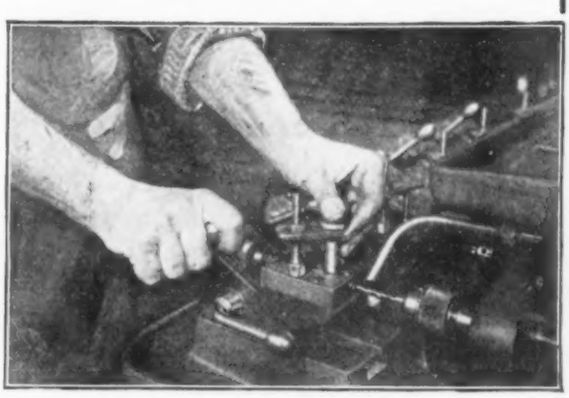
The Detroit Machine Tool Co., Detroit, Mich.

Makers of

DETROIT

Semi-Automatic Drilling Machines





Tapping 600 Per Hour on the Rickert-Shafer Tapping Machine

The Rickert-Shafer design, by which the pressing of the work against the tap forces the aluminum friction disc against the specially-treated frictions, has set remarkable records in the big plants of America. In the Chicago shop of Beneke & Kropf Mfg. Co., makers of the world-famous "Rayfield" Carburetor, the girl shown is tapping 600 aluminum hot-air elbows per hour.

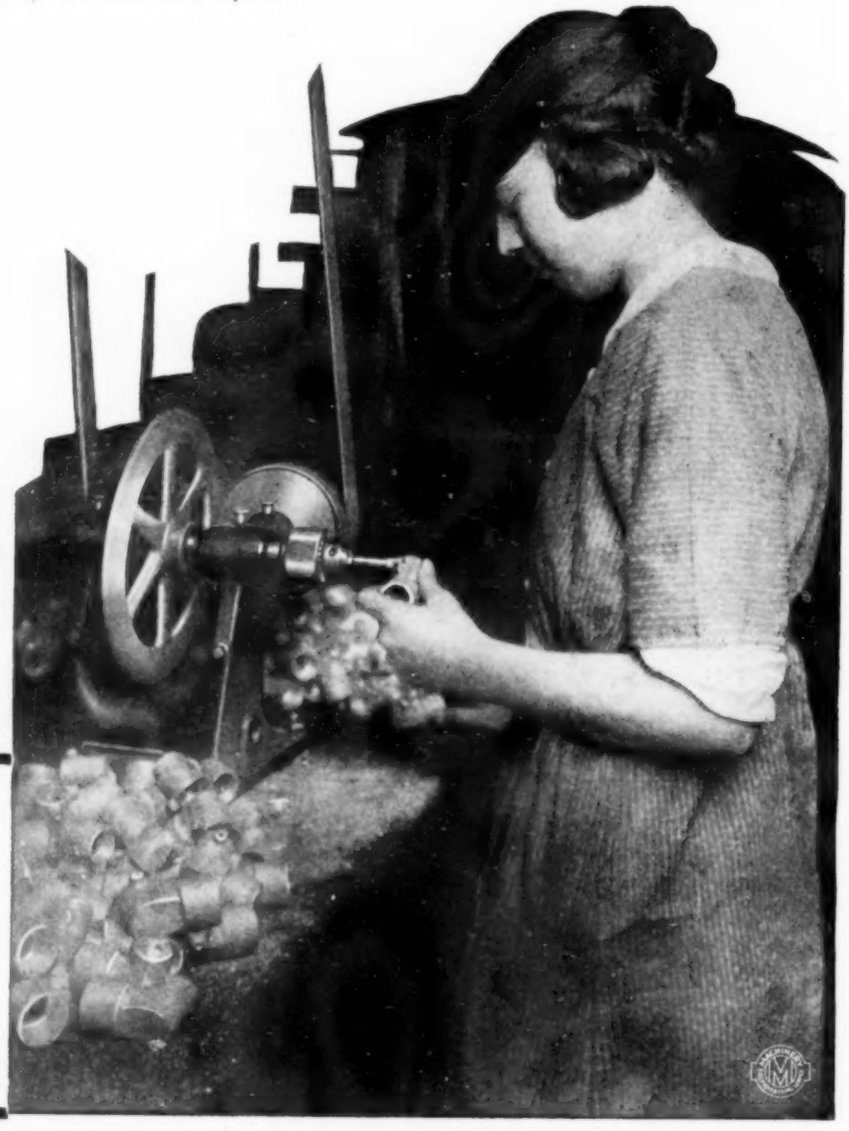
The foreman states: "I know of no more rapid method of Tapping. There is no jolt, no jar, just a natural pick-up." A hole 3/8-in. deep is tapped for a screw of 1/4-in. diameter, 20 threads to the inch.

Needless to say, precision is an equally essential requirement on "Rayfield" Carburetors. In fact, for both precision and production, "R.S." tappers, with their shock-absorbing friction drive, are without equal.

"I Know of no more Rapid Method"

R. S. Tapping Machines are made in various sizes and styles, and include Horizontal, Vertical and Radial Tappers. Let us recommend the right R. S. Tapper for your work.

Write today for descriptive booklet



Rickert-Shafer Co.

Erie, Pa.

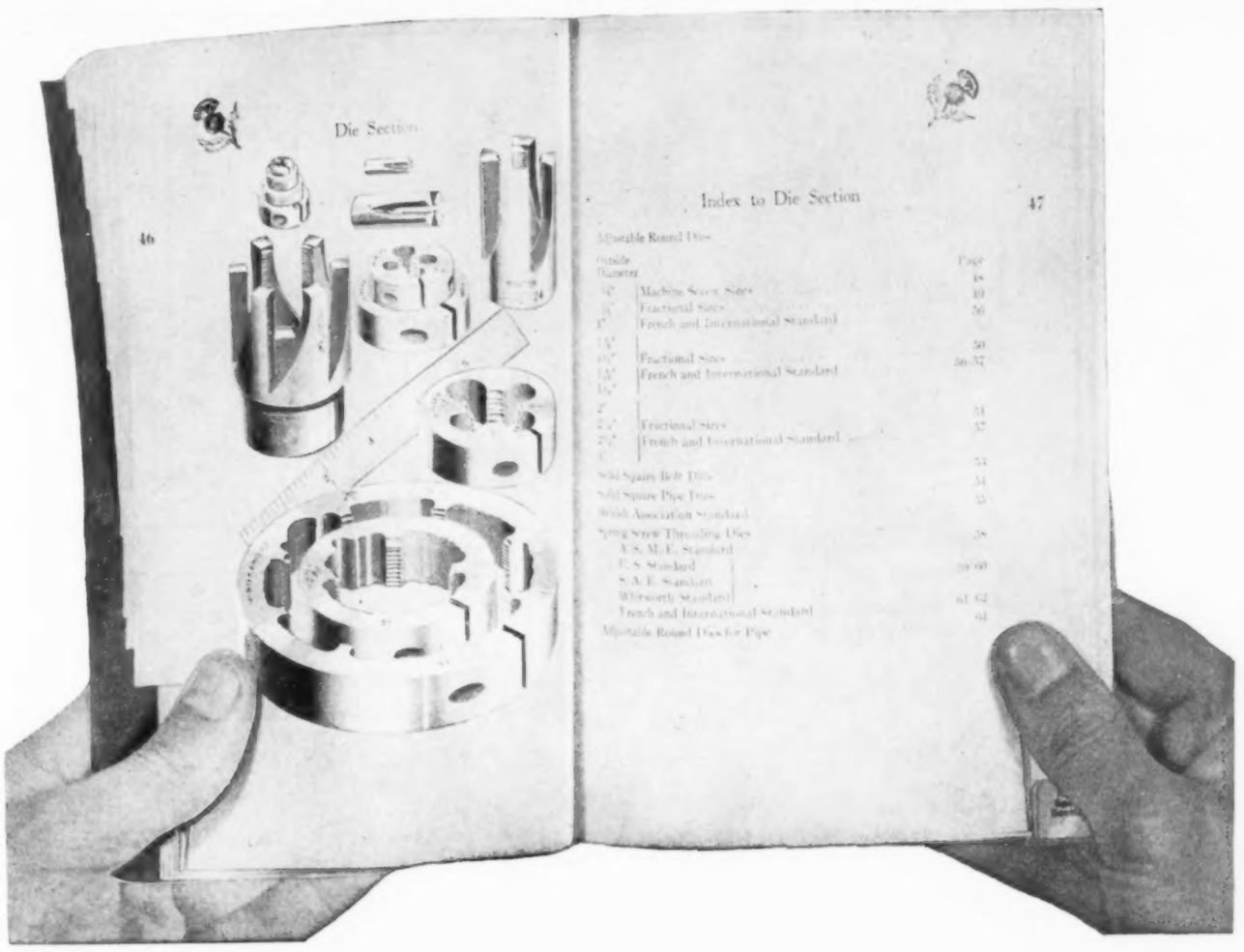
New York Office: 50 Church St.
Cleveland Office: 380 Rockefeller Bldg.
Detroit Office: 66 W. Larned St.
Chicago Office: 117 N. Jefferson St.
Cincinnati Office: C. M. Biggar & Co.
Philadelphia Office: Bourse Bldg. Machinery Exhibit

Agents for Belgium: Ateliers De Moor Brussels

Makers also of Rickert-Shafer

(formerly Boehm)

Automatic Die Heads



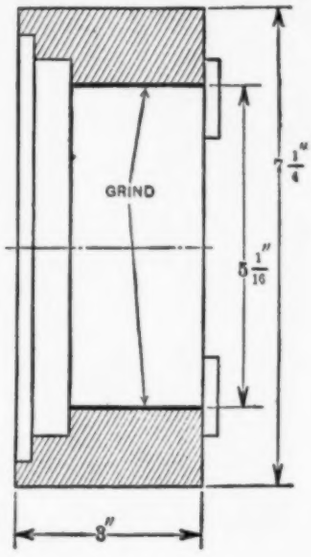
SAY

This Is the Real Thing!

The new No. 14 Catalog just issued by Winter Bros. Co. not only tells you all about their line and prices but, in keeping with Winter custom, gives you a lot of tips on threading. There are 124 pages cram full of illustrations, descriptions of the wide Winter line and general information tables, formulas, speeds, etc. It's a real handbook for the machinist. The various sections are thumb indexed to enable the busy man to easily find just what he's after.

You need it for a reference book in your tool room and on your desk. Send for it now.

WINTER BROS. CO., Wrentham, Mass.



CAM
FOR DIE HEAD

Attached to the toolpost of the engine lathe on which this cam has been machined, the Dumore Grinder accurately grinds the hole without necessitating another "set up." The high efficiency standards of the Geometric Tool Co. (New Haven, Conn.) make comment unnecessary on this method of handling the job. It is sufficient that the work of the Dumore is so satisfactory, the finish so fine, that all cams this size or larger, made in this shop are ground in this manner.

The Average Shop Has Constant Use for Dumore Grinders

Dumore Grinders are made in types and sizes that can be attached to all classes of machines and used to successfully perform a wide variety of grinding operations.

Equally valuable for the important "odd jobs" that must be done in every shop and on some manufacturing work, they find a ready place in every part of every metal working plant—whether toolroom, factory or repair shop.

Ask us about DUMORE Grinders—full details on request.

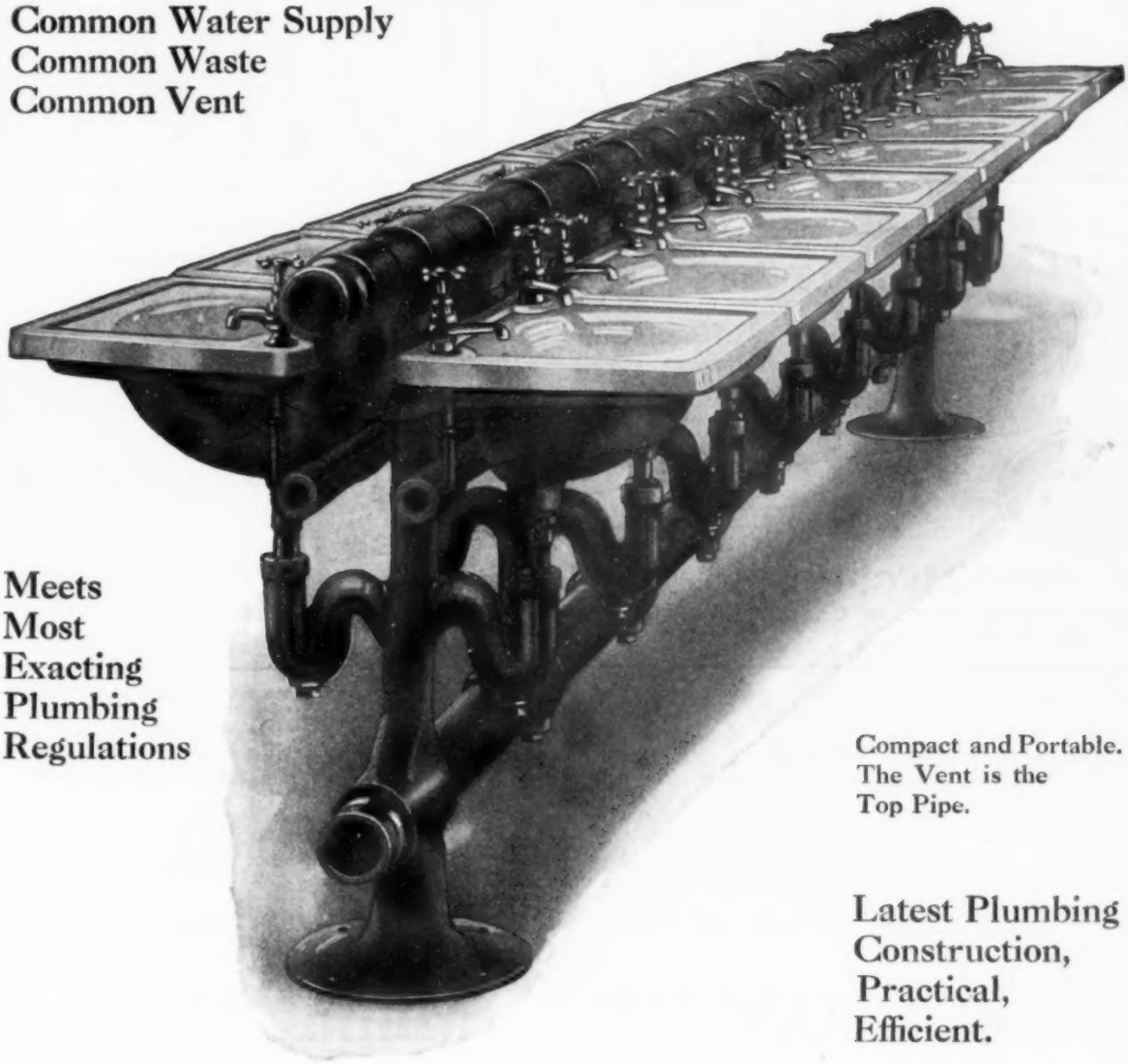
Wisconsin Electric Company

2730 Sixteenth Street **Racine, Wisconsin**

DUMORE HIGH SPEED GRINDERS

Victory Wash Bowls

Common Water Supply
Common Waste
Common Vent



Meets Most Exacting Plumbing Regulations

Compact and Portable.
The Vent is the Top Pipe.

Latest Plumbing Construction, Practical, Efficient.

ONE OF THE TYPES OF WASH BOWLS MANUFACTURED BY US.

Our Lines Include SANITARY WASH BOWLS (in Batteries), BUBBLING FOUNTAINS (Plain and Ice Cooled), METAL LOCKERS, METAL STOCK AND PATTERN STORAGE RACKS, METAL SHELVING, METAL CABINETS, VAULT FIXTURES, SODA KETTLES (40 and 60 Gallons), METAL STOOLS AND CHAIRS, WATER MIXERS, WORK BENCHES, BENCH LEGS, FULL LINE OF PLUMBING FIXTURES, Etc.

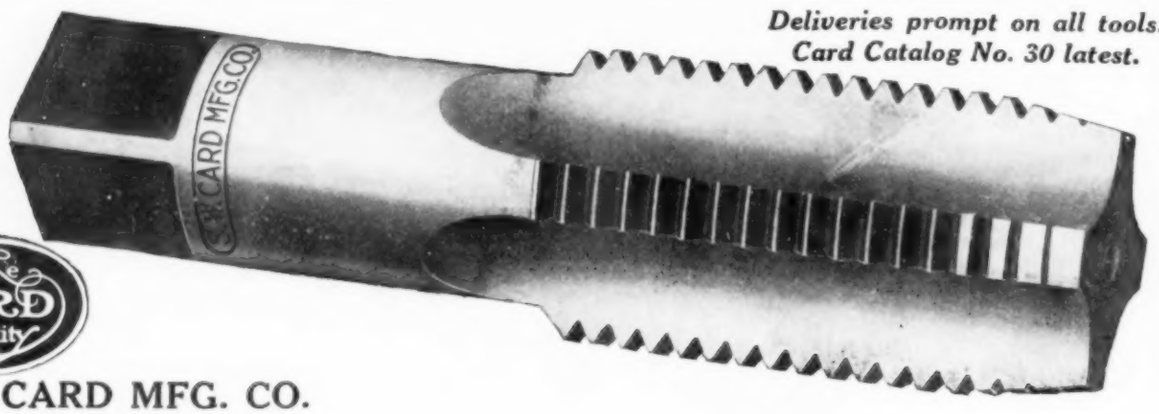
Manufacturing Equipment and Engineering Co.

Works and Mail Address: Framingham, Mass.

Boston Office: 136 Federal Street

CARD *for* THREADING

Deliveries prompt on all tools.
Card Catalog No. 30 latest.



The CARD Quality

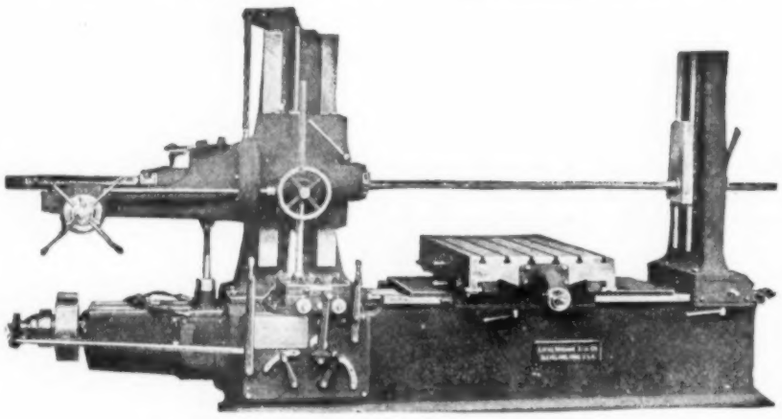
S. W. CARD MFG. CO.
Division of Union Twist Drill Co.
Mansfield, Mass.

Coarse Feeds or Precision Finishes

The Lucas is so designed and constructed as to successfully withstand the strains imposed by coarse feeds at high speeds in tough materials. On the other hand, it is so refined as to actually hold to the extremes in precision finishes.

It bores, drills, mills, etc., and all with equal speed and accuracy. The details will interest you.

"PRECISION" Boring Drilling and Milling Machine

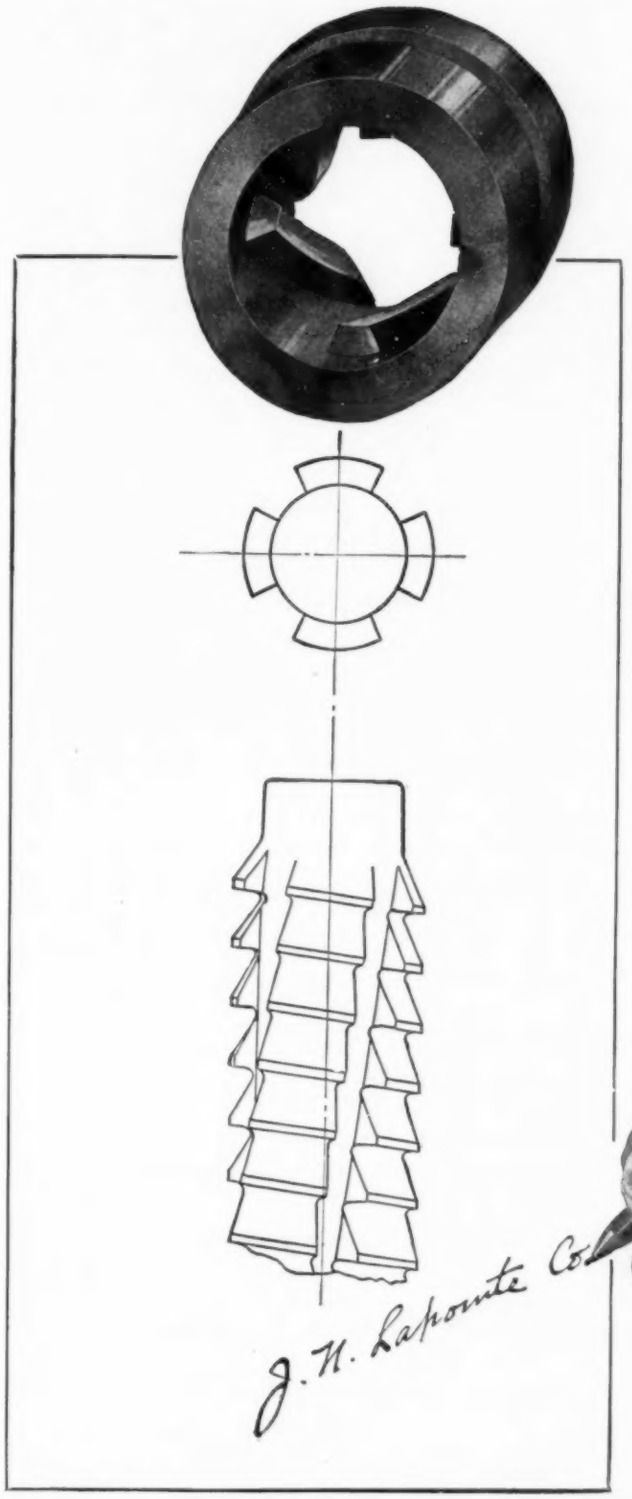


Lucas Machine Tool Co.

NOW AND ALWAYS OF

Cleveland, Ohio

Alfred Herbert, Ltd., Coventry; Societe Anonyme Belge, Alfred Herbert, Brussels; Allied Machinery Co., Turin, Barcelona, Zurich; Aux Forges de Vulcain, Paris; Benson Bros., Sydney, Melbourne; V. Lowener, Copenhagen, Christiania, Stockholm; R. S. Stokvis & Zonen, Rotterdam; Andrews & George Co., Tokyo.



"Broaching makes a spiral cut cheaply"

SPIRAL grooves are broached as easily as any other cut, with the proper arrangement of the broaching machine. This usually consists of a revolving broach holder attached to the drawhead and a broach guide grooved corresponding to the desired cut. In some instances the piece is put on a work bushing which revolves according to the spiral of the broach teeth. In any case, a very high hourly production is attained at slight tool-cost.

Pieces which require such a cut, and which hitherto have not been used because of the expense of machining them are now quite feasible because they can be cheaply made by broaching.

Increasing machining possibilities while decreasing machining costs is the achieved purpose of broached and broaching machines made by the

J. N. Lapointe Co., of New London

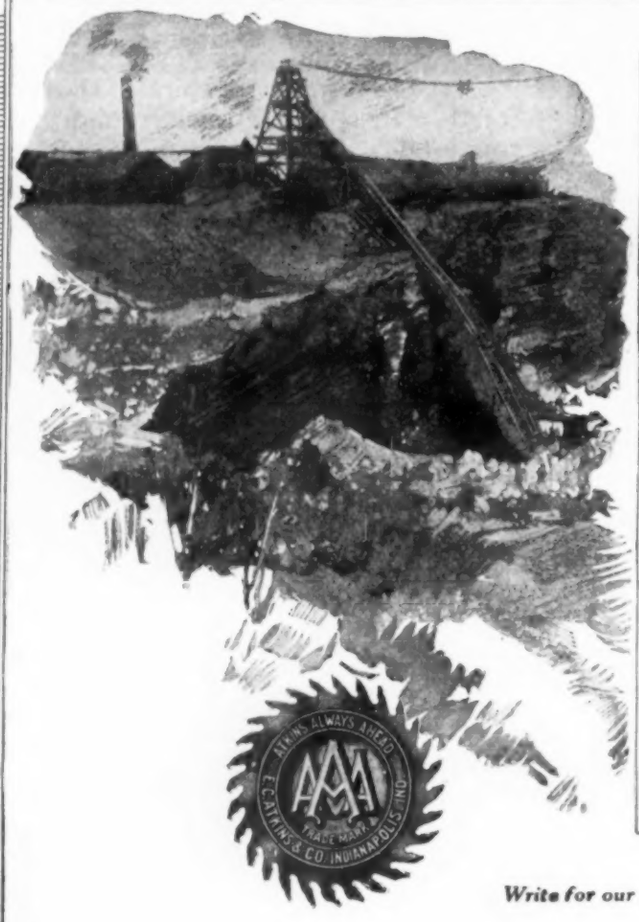
J.N. LAPOINTE CO.
of NEW LONDON, CONN.

DETROIT OFFICE: 11 HARPER AVENUE

2060-L

Representatives: GREAT BRITAIN: Charles Churchill & Co., Ltd., 9-15 Leonard St., Finsbury, London, E. C. FRANCE: Fenwick Freres & Co., 8 Rue de Rocroy, Paris. BELGIUM: Fenwick Freres & Co., Liege. SWITZERLAND: Fenwick Freres & Co., Zurich. ITALY: Fenwick Freres & Co., Torino. SPAIN: Fenwick Freres & Co., Barcelona. JAPAN: Commercial Co. of Tokio, Tokio. AUSTRALIA: H. P. Gregory & Co., Sydney. NORWAY: Gustav Nielsen, Christiania. SOUTH AMERICA: W. R. Grace & Co., Hanover Sq., P. O. Box 286, New York City. DENMARK: Ch. A. Herstad, Copenhagen. FINLAND: Ch. A. Herstad, Copenhagen, Denmark. SWEDEN: Chr. A. Herstad, Stockholm.

ATKINS SILVER STEEL SAWS



VIRGIN ORE

When Elias C Atkins began making saws 'way back in 1857 he realized that no steel manufacturer had at that time the correct formula for making as high a grade of steel as he determined to use in *his* saws.

Being an expert metallurgist he prepared his formula, which was based on Virgin Ore. This formula contained many important elements that stamped it as the best that had ever been used. Experiments were carried on day by day and month after month, and after a long interval success was achieved—thus "Silver Steel" Saws were born

This steel—*Atkins exclusive formula*—has the quality of receiving a hard, tough temper, stiff and firm, a quality that takes a keen, sharp cutting edge—a quality as fine as the material in high grade razors—that's "Silver Steel" and it's not too good for Atkins Saws

"Silver Steel" Saws—made from Virgin Ore—are known the world over, and the constantly growing demand demonstrates their quality

Have you Atkins Saws?

Write for our complete book on Metal Cutting Saws.

E. C. ATKINS & CO., Inc.

Established 1857 *"The Silver Steel Saw People"*

Home Office and Factory: INDIANAPOLIS, IND.

Canadian Factory: HAMILTON, ONTARIO

Machine Knife Factory: LANCASTER, N. Y.

Branches carrying complete stocks in the following cities:

Atlanta	Minneapolis	Portland, Ore.	Paris, France
Chicago	New Orleans	San Francisco	Sydney, N. S. W.
Memphis	New York City	Seattle	Vancouver B C

Predictable Quality and Long Life Mark Detroit Twist Drills

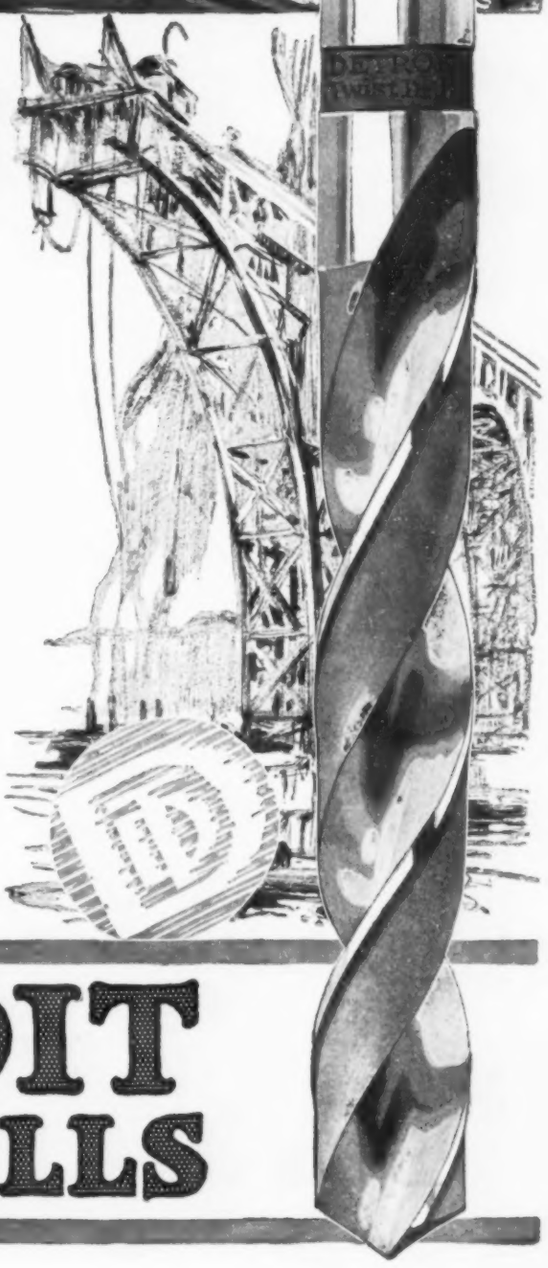
Those who are furthering America's industrial progress use Detroit Twist Drills for two excellent reasons:

Their quality is so uniformly high that the kind of service they give can almost be determined in advance.

And they give more accurate holes with less regrinding and less cost for power.

When ordering, specify
Detroit Twist Drills

Detroit Twist Drill Company, Detroit, Mich.
New York Sales Office: **45 Warren Street**



DETROIT TWIST DRILLS

GIANT
Keyseating Machines

All That the Name Implies

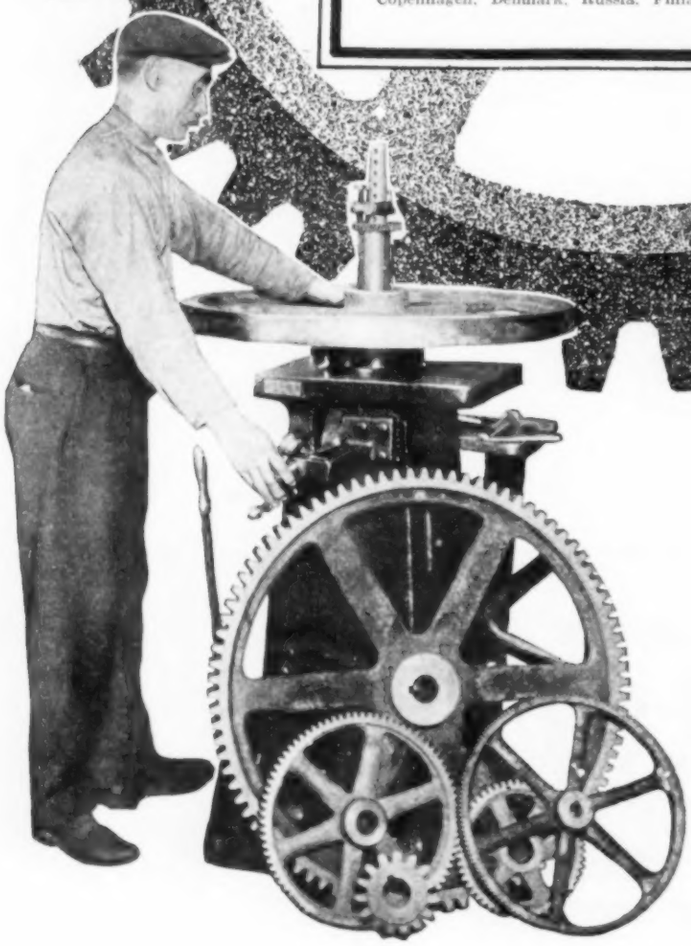
The **"Giant"** is doing a *super-job* every day in hundreds of machine shops. Practically any shape or size of keyseat—straight or tapered—can be cut with the greatest of ease.

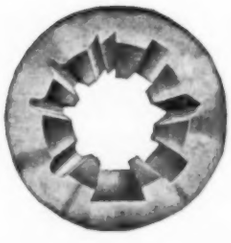
Our engineering department will be glad to submit guaranteed estimates of **"Giant"** production on your work.

MITTS & MERRILL

913 Tilden Ave., Saginaw, Michigan

FOREIGN AGENTS: Burton, Griffiths & Co., London, England; Aux Forges de Vulcain, Lyons and Paris, France; Isbecque, Todd & Co., Brussels, Belgium; Nielsen & Winther, Copenhagen, Denmark, Russia, Finland, Siberia, Argentina.





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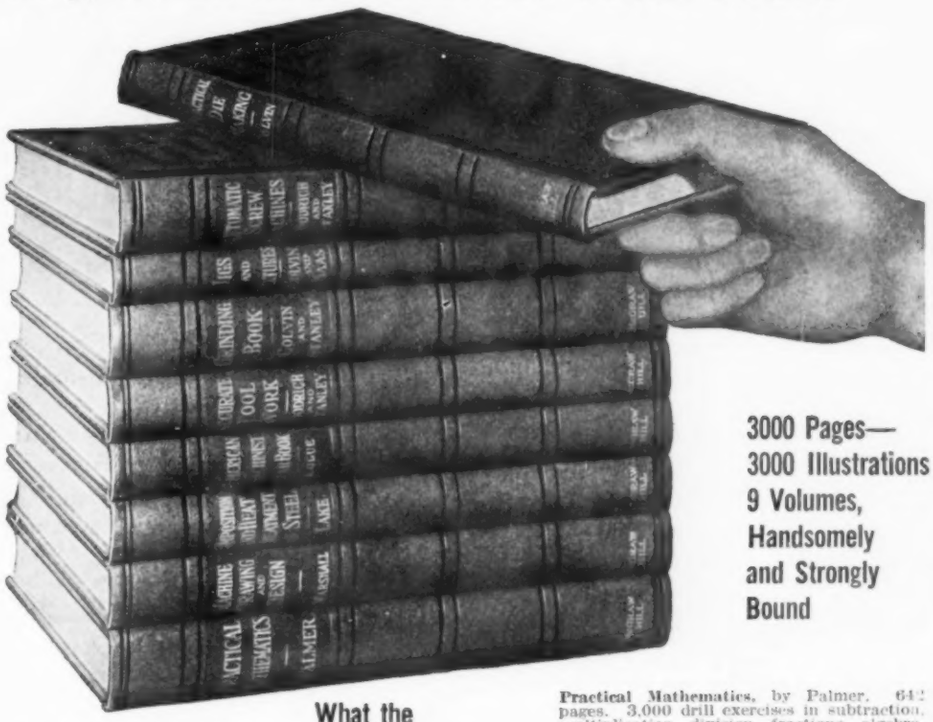

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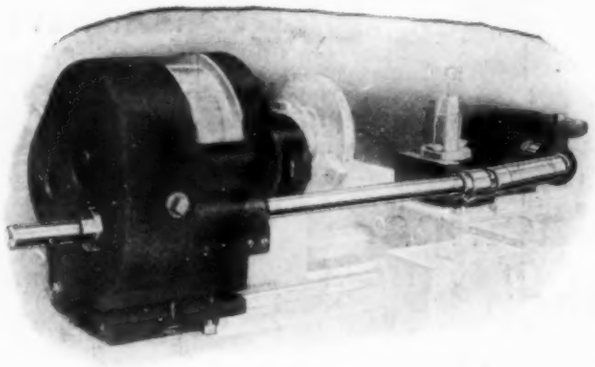

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Our catalog is of value to every man interested in lathes and their accessories. Let us mail you one for your files.

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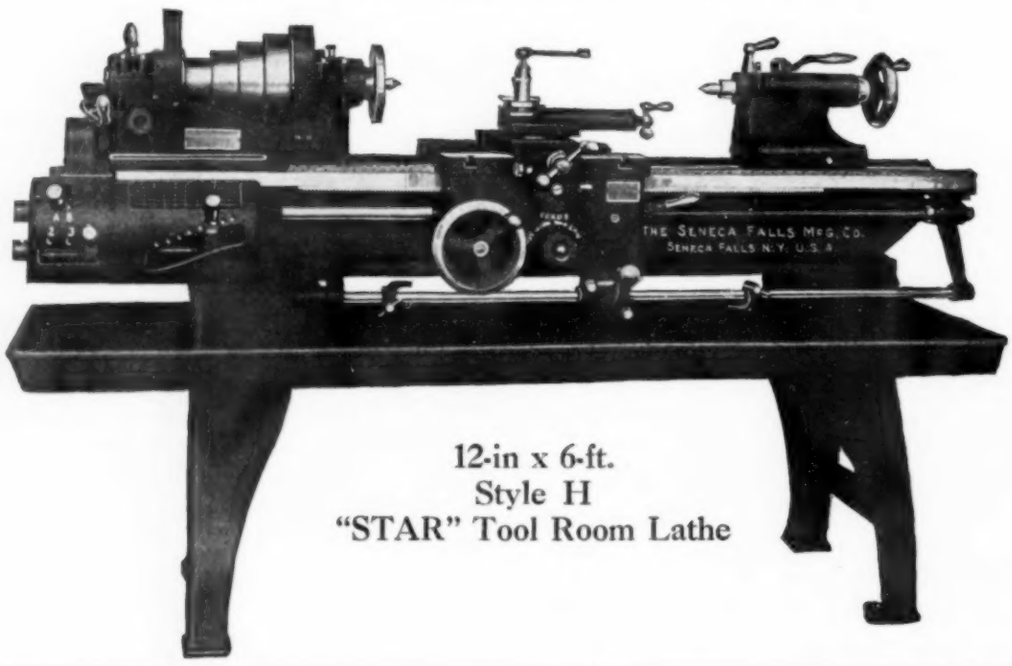

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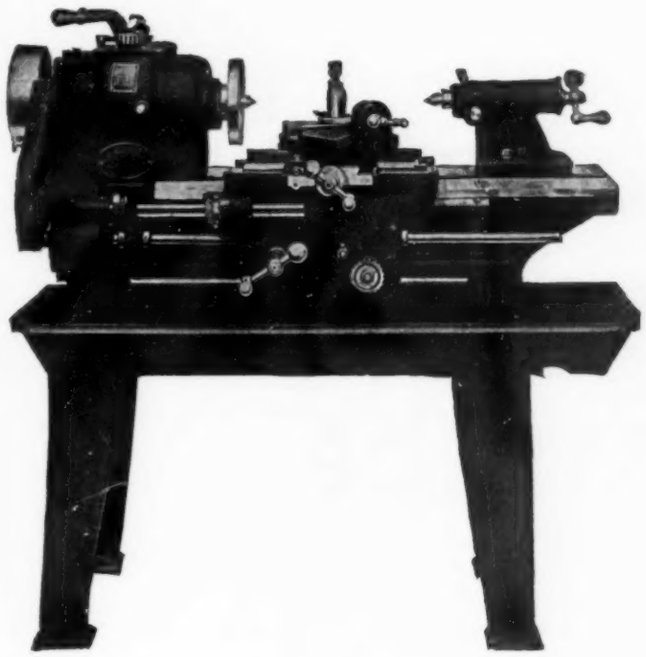

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It will pay you to call on our nearest agent and learn all about this machine. If not convenient to do this, send for Catalog.

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Are long-lived Tools, built not only for accuracy and speed, but to withstand shock and strain. **Latrobe** DRILLS AND REAMERS are the American Standard of Perfection and Efficiency wherever QUALITY in Tools is recognized.

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IF, instead of blindly trying to discover the fault in a screw by its feel in a ring gage as the darkey guesses at his boiler's steam pressure—

You just dropped the screw into a machine that told you at a glance the

Lead Error, Pitch Diameter Error
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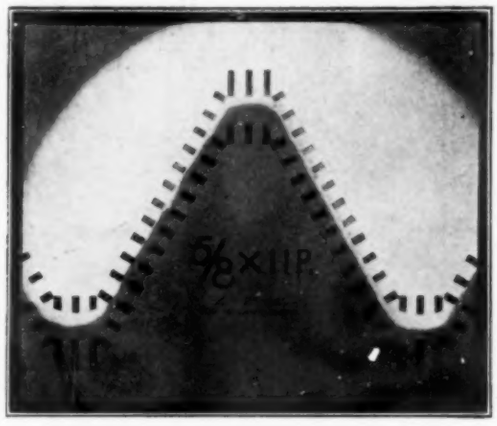
and by giving the screw a turn it showed at once if the screw was



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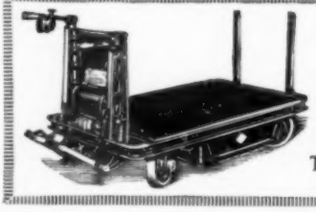

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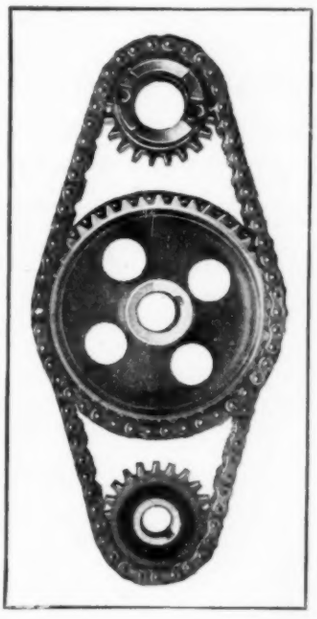

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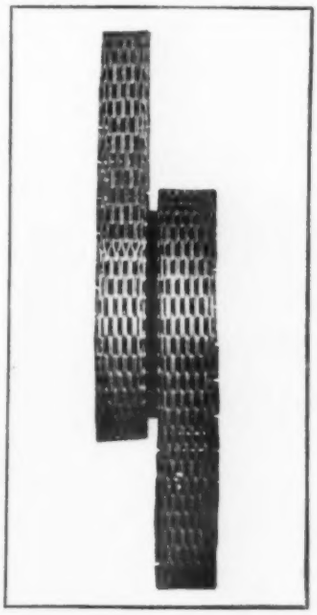

THE WHITNEY MFG. CO.

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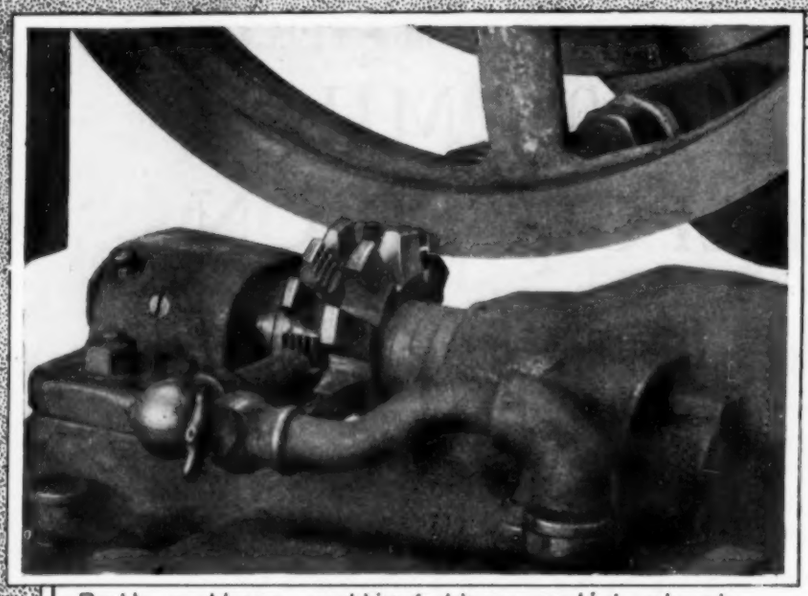
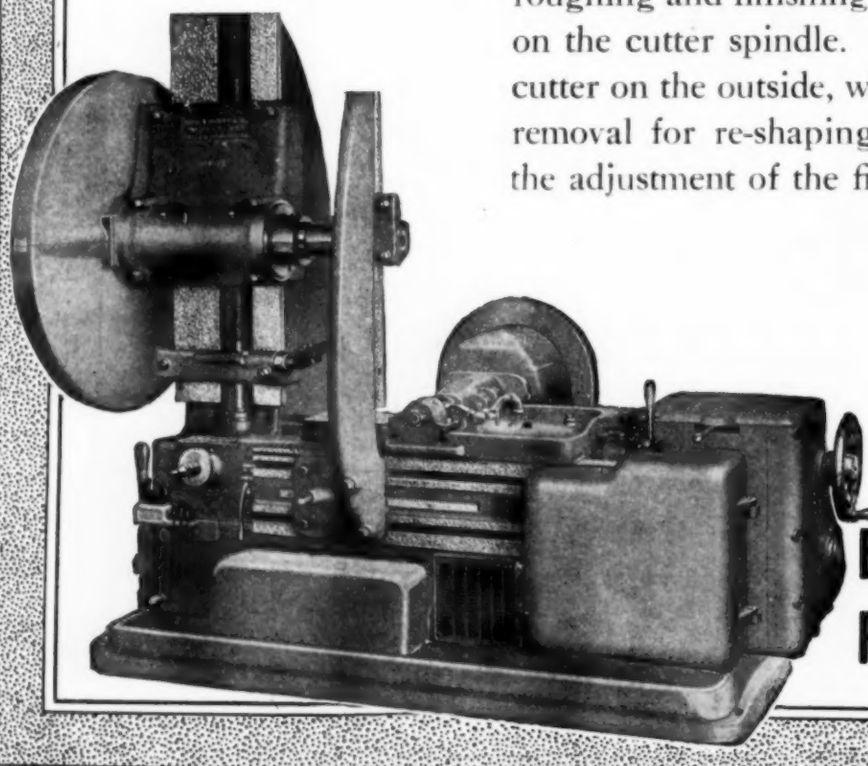


Both cutters cutting thru solid stock.. using slow feed for first cut.

STEPPING UP BROWN & SHARPE GEAR CUTTING BY USING

When a large number of gears are to be cut it has been found advantageous to make both roughing and finishing cuts at the same time by the double cutter method.

As shown in the illustrations above, both the roughing and finishing cutters are mounted on the cutter spindle. Note the roughing cutter on the outside, which permits its easy removal for re-shaping without disturbing the adjustment of the finishing cutter.



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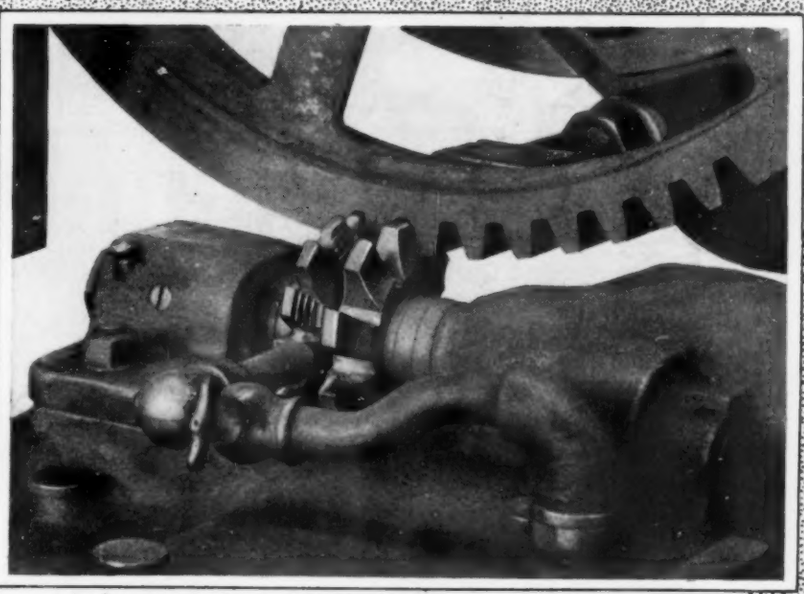
PRODUCTION ON AUTOMATIC MACHINES DOUBLE CUTTERS

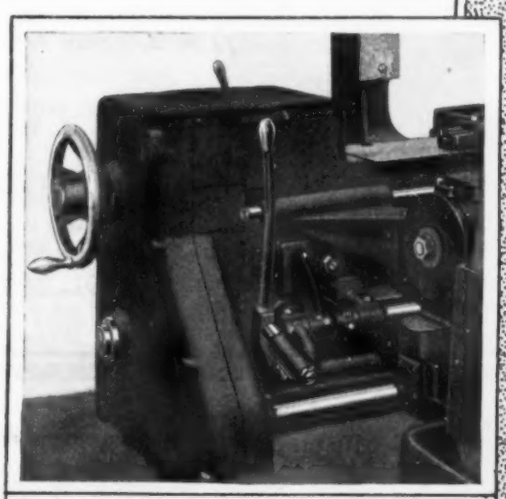


Using regular cutting feed for remaining cuts

When taking the first cut, both cutters must cut thru solid stock, requiring a slow feed. To avoid the loss of time and trouble, which would arise by either feeding by hand or changing gears, we have designed an Automatic Feed Change Mechanism, that can be furnished as an extra for use on our machines.

This mechanism is engaged for the first cut which is taken at a slow feed. At the first reversal of the cutter carriage the Feed Mechanism is automatically tripped, engaging a feed twice as fast for the remaining cuts.

Send for Catalog No. 137, *giving a more detailed description of these machines.*



Showing Automatic Feed Change-Mechanism for double cutters.

MFG. CO.,
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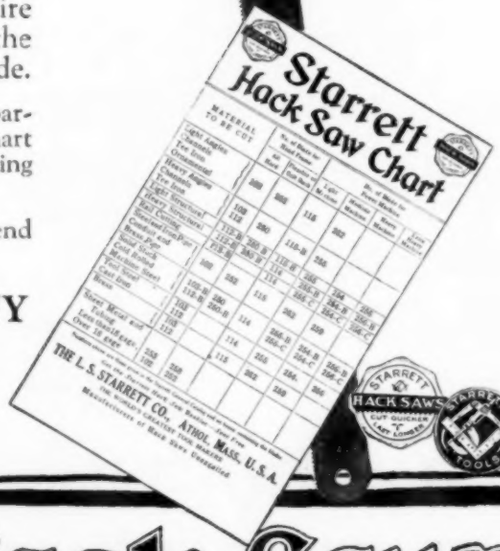
"Starrett saws have convinced me they are best, by test. The blade that cuts quicker and lasts longer, cuts labor costs, too."

But for a blade to cut quicker and last longer, it must be the right saw for the material to be cut. Many saws will cut more than one metal. But no saw will cut all metals equally well. The pitch of the blade, for example, varies according to the kind of material cut. Cold-rolled stock and machine steel are cut efficiently with the saw that has 10 teeth to the inch. But brass and soft metals require a fine-toothed blade. And pitch is but one of the things to be considered in selecting the right blade.

To make it possible to select the saw best suited to a particular kind or shape of metal the Starrett Hacksaw Chart was designed. Use it, it will help you cut your cutting costs.

A copy of the chart will be sent free upon request. Send for Catalog No. 22 "C".



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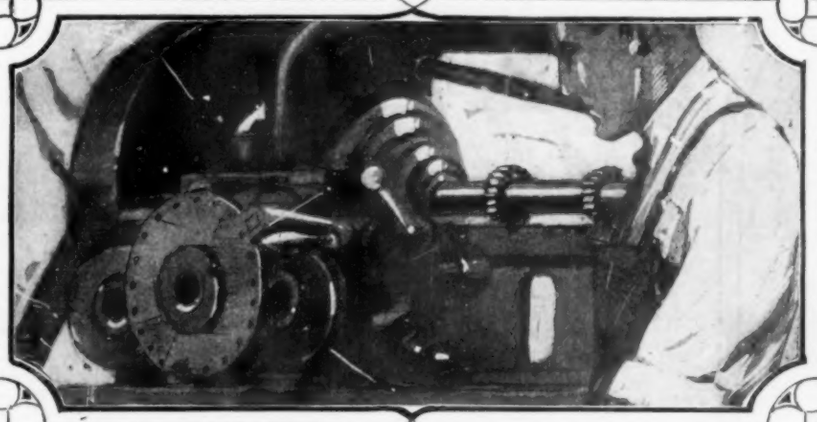

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Special cutters mean special prices.

The extension of our organization to the principal industrial centers of the world permits us to furnish your requirements direct from complete stocks.

You may obtain each type of standard "Union" Cutter from any of our exclusive agents listed below.

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DRILL AND CUTTER MAKERS

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The Tools you buy again

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The performance of a machine should be figured by the year, not merely by the hour. The expected output should properly be based on what the average good operator working with normal effort can produce in a day—not what an expert can do on a short time production "stunt."

This involves fundamentally correct design. In a grinding machine it means rigidity, power, sturdy wheel slide construction to take heavy cuts; well proportioned bearings and careful heat treatment of vital parts to insure freedom from trouble and delay. It means simple and easy operating control which assures continuous production without fatiguing the operator.

All these factors were amply provided for in the design of Norton Cylindrical Grinding Machines. The final result is a machine that has revolutionized grinding production—a consistent rapid producer of uniformly accurate work.

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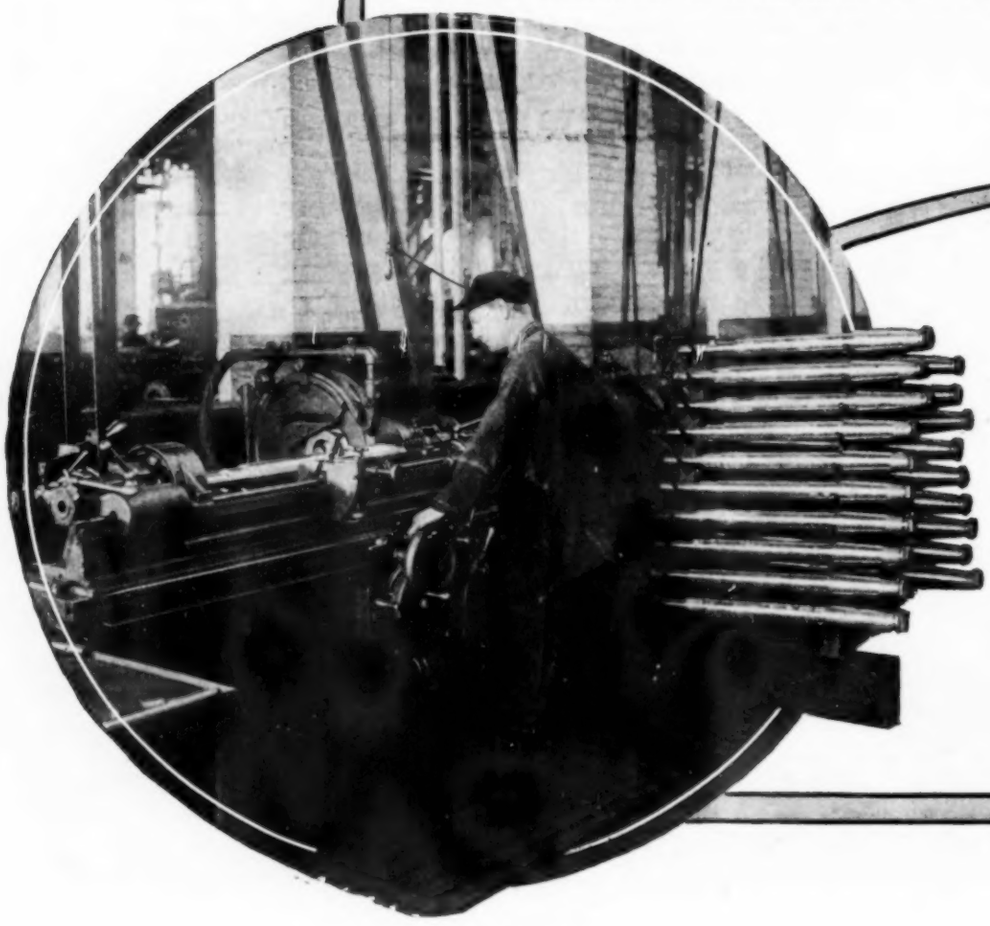

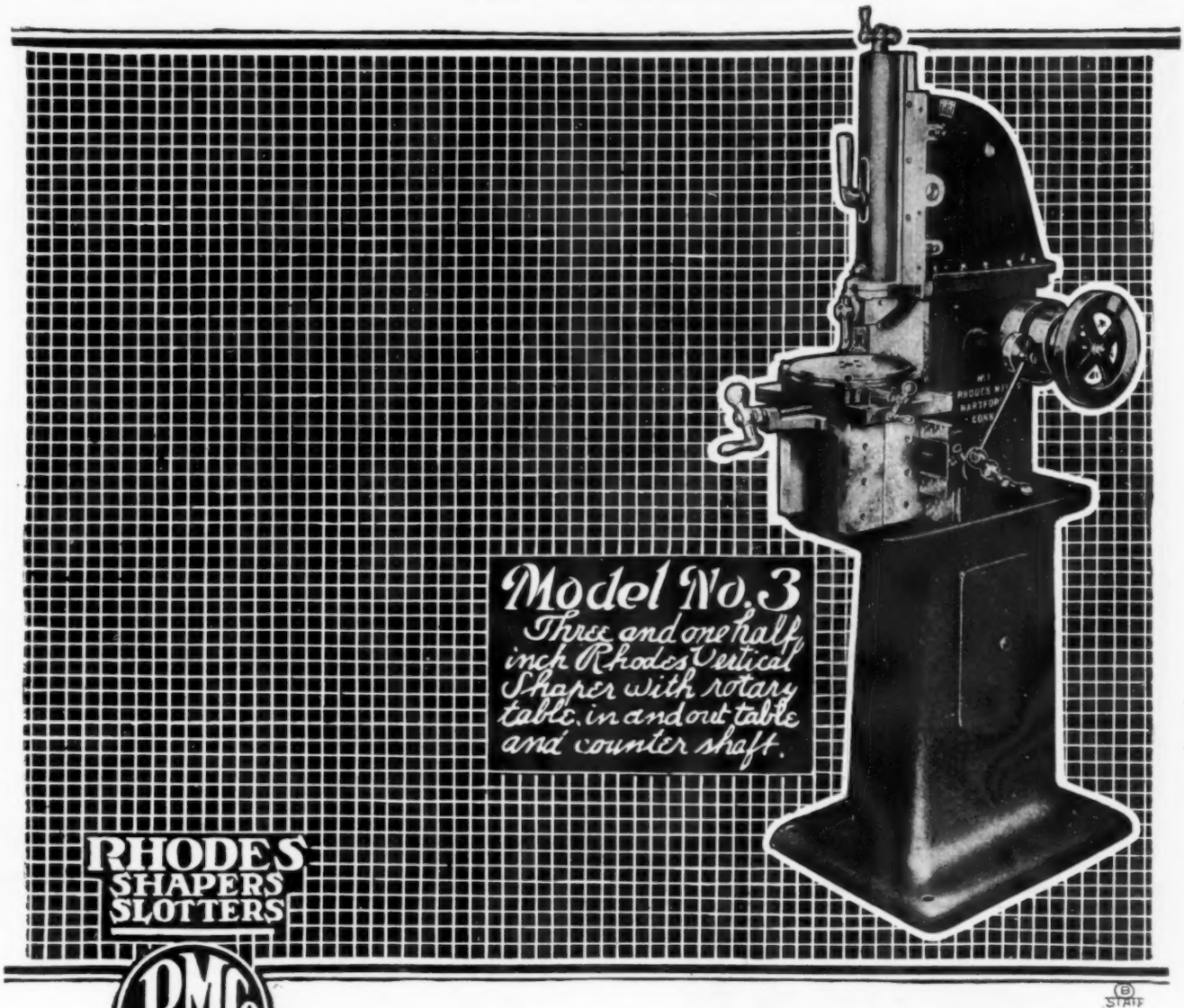
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Three and one half inch Rhodes Vertical Shaper with rotary table, in and out table and counter shaft.
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SHAPERS
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THE Rhodes Shaper is so simple to operate and control that close accuracy is assured. Rhodes Shapers please both operatives and employers, and are a paying proposition from the start.

Write for our descriptive Catalog, showing our three models, the 7-inch Shaper, the 3½-inch Slotter, and the combined Shaper and Slotter.

The Rhodes Manufacturing Co.
Hartford, Connecticut

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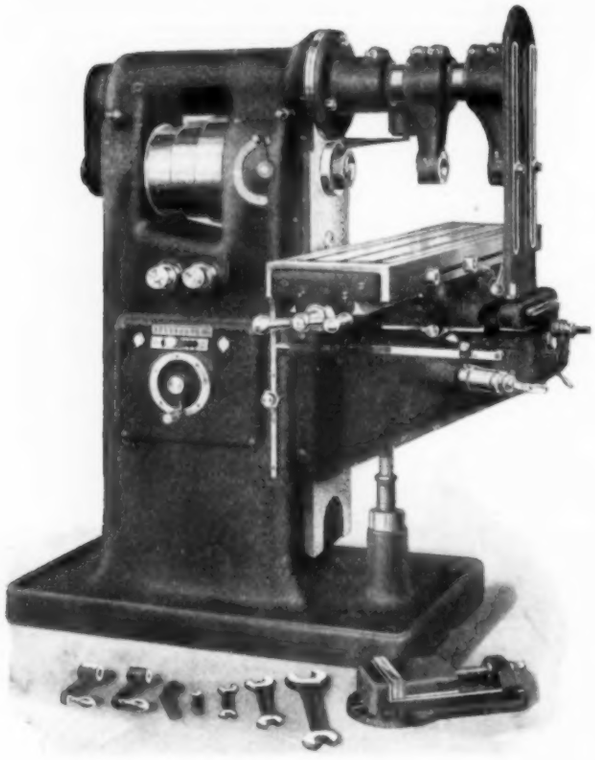
Victor Nut Facing MachineS

No. 0 Machine. Capacity ⅛ to ½ in. nuts. Production 10,000 ⅜ in. a day.

VICTOR Nut Facers are constructed on a very simple plan, are easily operated and seldom, if ever need any repairs. They are built of the best materials. No parts are exposed to wear except the High-Speed Steel Cutters in the facing head. When worn down they can be easily replaced at a very small cost to the user.

For rapidly facing nuts true to thread Victors fill the bill.

Victor Tool Co.
Waynesboro, Pa., U. S. A.



Rockford No. 2
Plain Heavy Duty
Milling Machine

Designed Primarily for Quantity Production. An Excellent Milling Machine for General Manufacturing

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Every controlling lever on this machine is located in front of the table, within easy reach of the operator; he need not move from his original position to regulate the feeds.

RIGIDITY

The back gears of the cone type millers are located inside the column, at the front of the machine. This prevents chatter and permits heavy cuts to be made.

OVERHANGING ARM

Solid steel 4-in. diameter. Provided with patented flanged support. This gives exceptional strength to cutters, reduces vibration, and minimizes any tendency of arm to elevate itself during deep cuts.

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Rockford, Ill.

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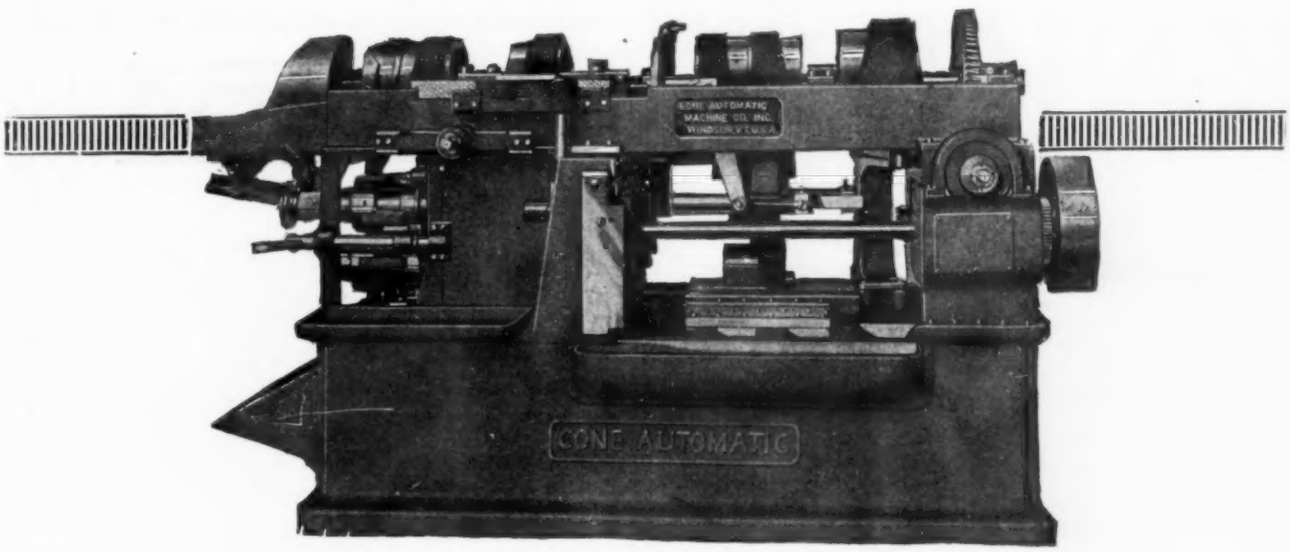

"A good machine made better." Unexcelled for accuracy and fast output of screw parts.

CONE

Automatic Four-Spindle Screw Machine

Our Catalog will give complete details. Send for a copy.

Cone Automatic Machine Co., Inc., Windsor, Vt.

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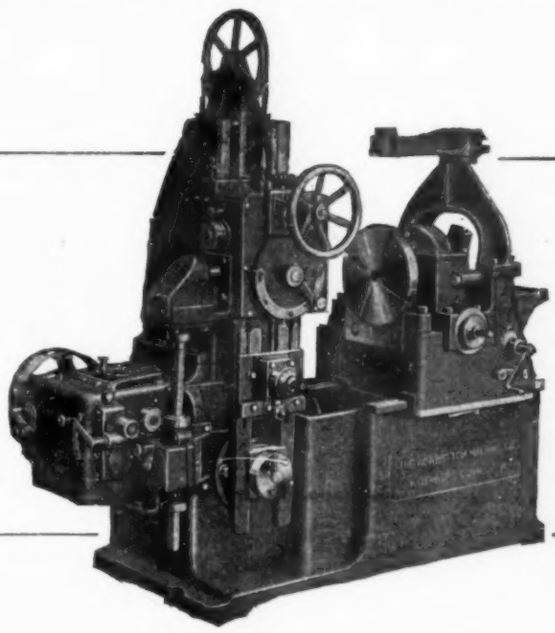
Cone Automatics are made in four sizes, 1-in., 1¼-in., 1½ x 6-in. long; 3½ x 7-in. long.

Make This a New Year's Resolution

The Machine or the Cams



The Rowbottom Machine Co.
Waterbury, Conn.
Factory: Waterville, Conn.

Rowbottom for Cams

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Milling and Drilling Machine

This is a machine which is capable of doing the work of *two* machines.

It is a drill press; it will drill or ream any object which can be clamped to its table.

It is a milling machine; it will mill (vertically or horizontally) anything within its range.

The Knight Milling and Drilling Machine is equipped with a tilting table. A piece can be clamped down and swung to practically any angle in the circle.

Drilling can be done at right angles to milled surfaces; frequently an entire job can be accomplished at one setting.

Are you interested in doing more work at less cost? Then let us show you the possibilities within your reach with the Knight.

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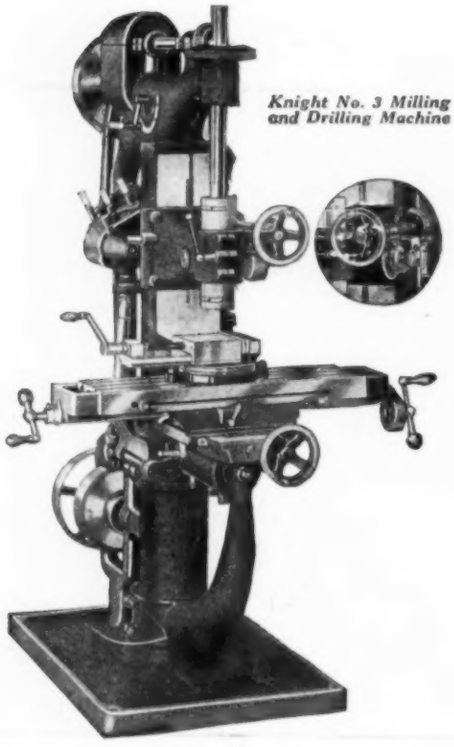
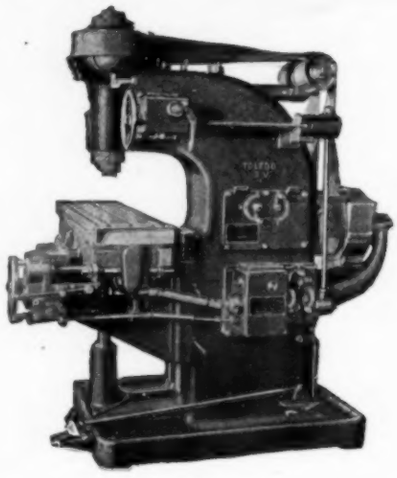


Knight No. 3 Milling and Drilling Machine

TOLEDO



Exceptional Spindle Bearing

The method of mounting the spindle on the Toledo Vertical Milling Machine is another feature that contributes to the superiority of this miller.

The main bearing is 3¼ inches in diameter and runs in a tapered sleeve 12 inches long, lined with two phosphor bronze bushings. This sleeve is adjustable to compensate for wear.

Better get the full story about this phenomenal miller.

The Toledo Milling Machine Co., Toledo, O.

Spacers for Milling Machines Arbors, etc.

For arbors of the following diameters, ½, ⅝, ¾, ⅞, 1, 1⅛, 1¼, 1⅜, 1½, 1⅝, 1¾ 1⅞, 2, 2¼, 2½ and 3½ inches.
.003, .005, .015 and .025 inch thicknesses in stock.
.0015 to 3.000 inch thicknesses made to order.

Prices and Samples on Request.

Detroit Stamping Company

951-957 West Fort Street, Detroit, Mich.

For Manufacturing, Jobbing, Repairing

The handy size of the **Bilton No. 25 Plain Horizontal Miller** insures extreme ease of control. Its accuracy and close adjustment places it in the toolroom class; its adaptability fits it for general manufacturing; its economical operation makes it in demand for general jobbing and repair shops.

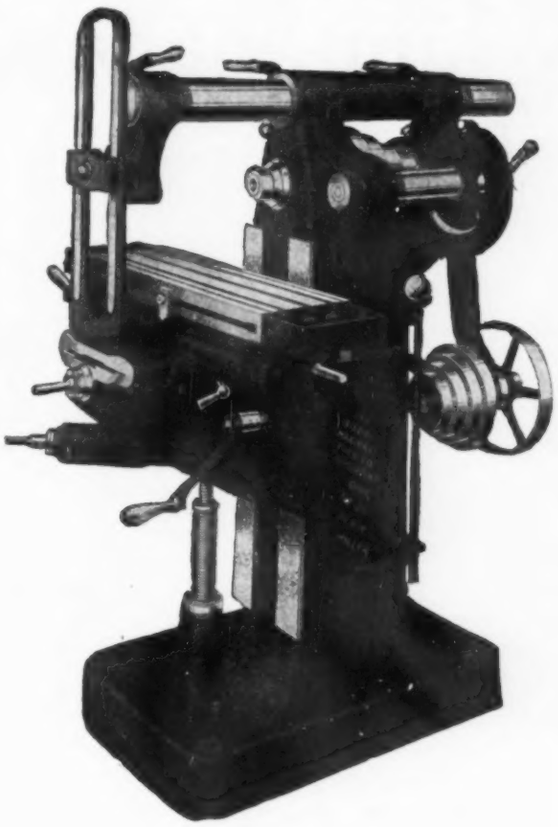
It has a table capacity that will accommodate many jobs ordinarily put on larger and more expensive machines.

We have a limited number of these machines for immediate delivery — first come, first served.

Meanwhile, get the latest catalog.

The Bilton Machine Tool Co.
Bridgeport, Conn.

FOREIGN AGENTS:
Alfred Herbert, Ltd. M. Mett Engineering Co. Chas. Churchill & Co.

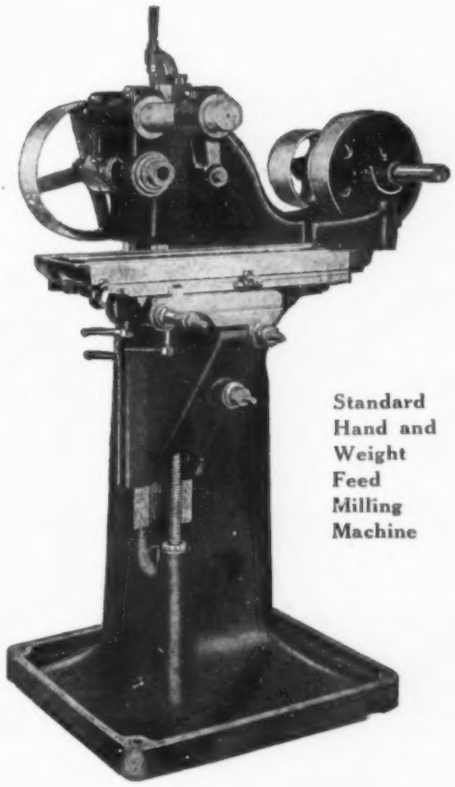


Success Depends Upon Conservation

The day has passed when any old machine that could produce the job was good enough. The progressive manufacturer fits the machine to the job and gets greater profit by conserving floor space, power and operating strain. He also saves the big item of initial installation cost. That's why you see so many *Standard Hand Feed Milling Machines* operating today. Accuracy, speed and economy in milling output—that's *Standard* performance.

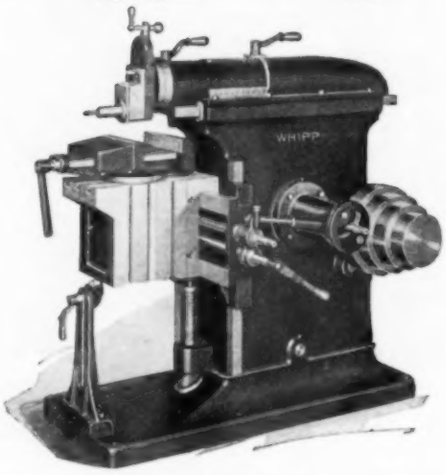
There are many *Standard* operations described in the Bulletin. Get your copy and note the range.

The
Standard Engineering Works
Pawtucket, R. I., U. S. A.



Standard Hand and Weight Feed Milling Machine

Whipp Shapers



This 20 in. back geared crank shaper will get your work out quickly and accurately. It has distinctive features that will appeal to the man who is responsible for production.

For small work our 16-in. single or back geared is what you want.

Ask for particulars.

THE WHIPP MACHINE TOOL CO.
Sidney, Ohio, U. S. A.

No Limit

to the Variety of Internal

KEYSEATS

that can be milled with this tool. It mills keyseats for straight keys and taper keys and keyseats for double or multiple keys. We make special tools of same design for extra long length holes which are difficult to keyseat on keyseating machine or on any other machine, and for this tool it is simple.

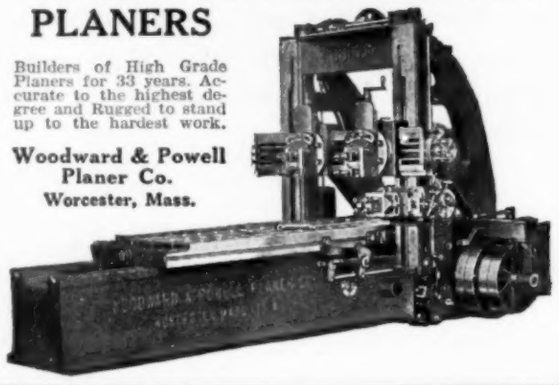
CATALOG D

National Machine Tool Co.
2270-2272 Spring Grove Ave., Cincinnati, Ohio, U. S. A.

WOODWARD and POWELL PLANERS

Builders of High Grade Planers for 33 years. Accurate to the highest degree and Rugged to stand up to the hardest work.

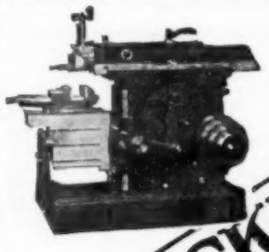
Woodward & Powell Planer Co.
Worcester, Mass.



How You Can Save On Your Milling Jobs

Instead of doing light milling on heavy machines you can make a substantial saving by installing a Briggs High Duty Miller for such work. It is a fast, accurate machine for general use in the tool room and machine shop. The solid frame and heavy bed (so radically different from the usual built-up construction) make it extremely rigid. The table has a screw feed and is provided with a quick return. Cutters and arbors can be changed quickly. Do you want a copy of the "Briggs Bulletin"?

Gooley & Edlund
Incorporated
Cortland, N. Y.



The Shaper with the 2-piece crank motion for 1921

STOCKBRIDGE SHAPERS

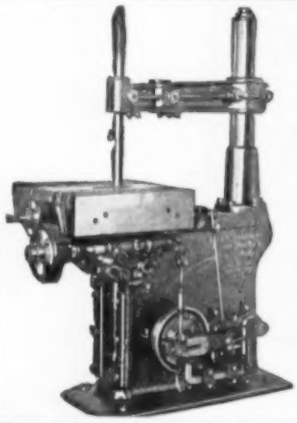
Write for Bulletin

The Stockbridge Machine Co.
Worcester, Mass.

Accurate Keyseats

An inaccurate keyseat may easily cause an expense in fitting that will equal the cost of cutting a great many keyseats.

BAKER Keyseaters



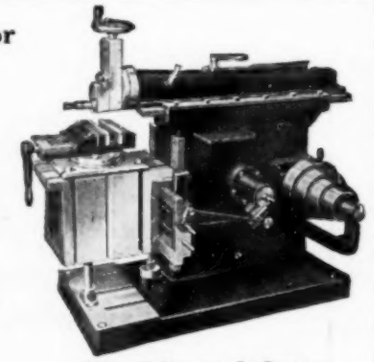
Insure your keyseats being cut with maximum accuracy. These machines operate on the draw-cut principle. They are rapid producers.
Ask us to mail you a copy of our Bulletin on Keyseaters and Slotters.

BAKER BROTHERS
Toledo, O., U. S. A.

Can't be Beat for Fast, Accurate Shaping

Yet moderately priced—30 years' experience has produced many features in these shapers that permit quick adjusting and rapid production. Note extended base with table support, Steel rocker arm, and all gears of steel.

Built in 3 sizes: 16 in., 20 in., and 24 in.

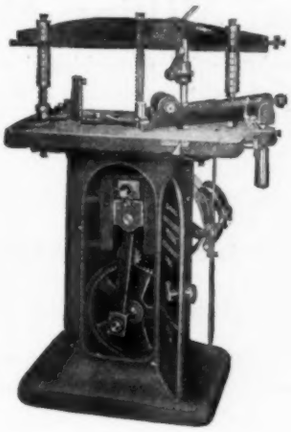


The Osborne & Sexton Machy. Co.
Columbus, Ohio

Davis Keyseaters

are as much a part of the equipment of any shop or tool room as a lathe or shaper.

They save time and labor, which is the essential thing in keeping the cost of production down in these days of high labor costs and they save the big machines for the big jobs.



Davis Machine Tool Co., Inc.
Rochester, N. Y.

It pays to use high-grade machine tools

This Hand Feed Miller
$155

Why buy a heavy cumbersome and expensive milling machine when you can do your small milling operations to better advantage and much more rapidly on a light Burke Milling Machine, either bench or column type?

Catalog shows other sizes of Milling Machines with hand or power feed, with or without overhanging arm. Either bench or column type, also Tapping Machines, Drill Presses and Cold Saws.

Burke No. 3

The Burke Machine Tool Co.
520 Sandusky St., Conneaut, Ohio, U. S. A.
Dealers in all foreign countries. Write for addresses

6,500 pieces in one day on the Chicago Small Miller

By an inexperienced operator, too—a boy. And at half the cost of doing it on a large machine.

The micrometer adjustment on the knee adapts this machine to gear cutting and kindred work. Six speeds and self-oiling are Chicago features conducive to high speed production.

CHICAGO MACHINE TOOL CO.
647 Washington Blvd.
Chicago, Ill., U. S. A.

The Wisconsin
Motor Driven Hand Miller

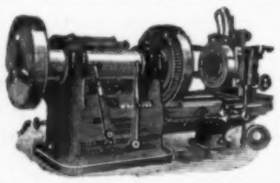
is the logical machine for your shop, because it *increases* production and keeps productive cost *down*.

Mill your small duplicate parts for less money on a "WISCONSIN."

Write us for further details anyway.

Wisconsin Miller Mfg. Company
Station A
Milwaukee, Wis.

May your New Year be a Prosperous one.



Tube Mill Machinery—Seamless and Welded.
Rolling Mill Equipment. Rolls—Sand and Chilled
Pipe Threading and Cutting Machinery.
Castings—Gray Iron, Semi-steel, Cupola and Air Furnace.
Machine Work to drawings.

Standard Engineering Works, Ellwood City, Penna., U. S. A.

Gorton Engraving Machines

handle all classes of work in a wide variety of metals. They permit the work being done easily, rapidly and economically without the necessity of employing a skilled operator.

The necessity for hand work in finishing small parts, or in a variety of toolroom and experimental work is entirely done away with.

Write for description and details of the application of machine engraving to your product.

Geo. Gorton Machine Company
Racine, Wisconsin

The Stamets No. 44 Vertical Milling Machine

A heavy-duty milling machine that has the speed of a lighter machine is a winning combination. The Stamets' power quick-return gets in more cuts per hour—light or heavy—but every cut an accurate one. A machine built right all the way through.

Our Bulletin will certainly interest you.

William K. Stamets, Pittsburgh, Pa.

Enlarge Your Working Capacity the "Davenport" Way

The wide range of screw machine jobs and the large output made possible on the Davenport Multiple Spindle Automatic Screw Machine, enlarges the working capacity of any shop having this kind of work to do.

There's no sacrifice in accuracy or finish to get the "Davenport" output.

Many users say that they have taken on business which could never be touched under old production costs.

Let us send you our Catalog. Now

Davenport Machine Tool Co., Rochester, N. Y.

WE are manufacturers of Lincoln Type Milling Machines, Bench Milling Machines, Hand Milling Machines, and a line of reliable Screw and Lever Vises. Get our circulars and prices.

THE CARTER & HAKES MACHINE CO.
Winsted, Conn., U. S. A.

SHEET METAL MACHINERY

Power Squaring Shears....84 sizes	Conductor Pipe or Leader Machinery .....All sizes
Power Gap Shears.....16 sizes	Eaves Trough Machines....All sizes
Corrugating and Crimping Rolls .....20 sizes	Ridge Roll Dies.....All sizes
Corrugated Curving or Culvert Rolls .....6 sizes	Roll Roofing Machines
Forming and Roofing Presses 12 sizes	16-inch Heavy Duty Shapers.

THE STREINE TOOL & MANUFACTURING CO.
New Bremen, Ohio

SHAPERS

Smith & Mills Company
Cincinnati, Ohio U. S. A.

Foreign Agents—C. W. Burton, Griffiths & Co., London. G. & F. Limbourg, Freres, Brussels. Van Reitschoten & Houwens, Rotterdam. Gleanzer Perreaud & Thomine, Paris. Stussi & Zwiefel, Milan.

A new Way to Mill Threads

Hall Planetary Thread Millers

Reduces threading cost 50% on some classes of work. Cuts all style threads internal or external.

Write for particulars.

THE HALL PLANETARY THREAD MILLING MACHINE CO.,
Bridesburg, Philadelphia, Pa.

KELLY SHAPERS

Have the advantage of being the sole machine tool product of an organization of specialists. They possess correct design, unusual accuracy and are easy to operate. Three sizes single geared, four sizes back geared. **Write for a Catalog.**

THE R. A. KELLY COMPANY Makers of shapers only for 25 years
P. O. BOX 488 XENIA, OHIO, U. S. A.

Big Production is a Feature with Ohio Planers and Shapers

Send for Catalogs.

THE OHIO MACHINE TOOL CO.
Leighton St., Kenton, Ohio

Send Us Your Inquiries for

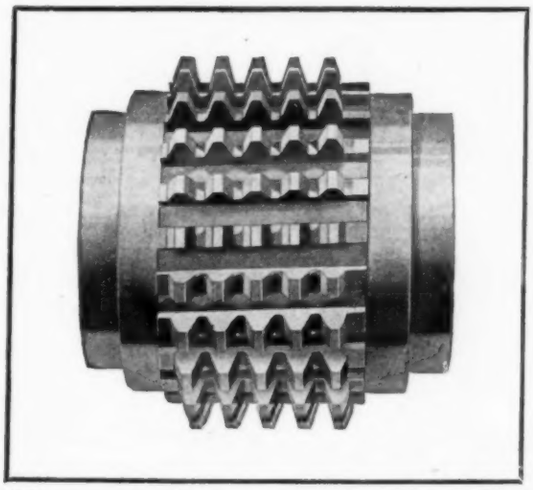
BOLT, NUT, FORGING AND WIRE NAIL MACHINERY

THE NATIONAL MACHINERY CO. TIFFIN OHIO U.S.A.

Pipe Threading and Cutting Machinery
Hand or Power Operated

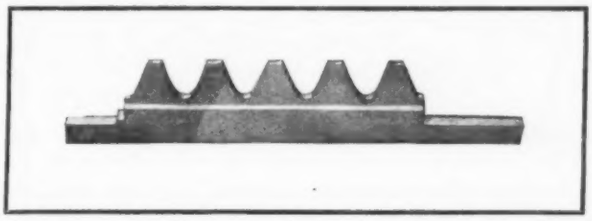
The Merrell Manufacturing Co.,
100 Curtis Street, Toledo, Ohio

Why Hob Teeth Retain Their Form When Sharpened



All hobs are made with relief on the tops of the teeth—*and at the bottom,* between the teeth.

The tooth section is the same at the back of the tooth as it is at the front of the tooth, whether it is a solid hob cut with a forming tool, a solid hob that is ground on the sides after hardening, or a LEES-BRADNER Hob such as we illustrate here, made up of high speed steel racks, which are ground *on the sides* of teeth with a large flat wheel after hardening and before assembling in the hob body.

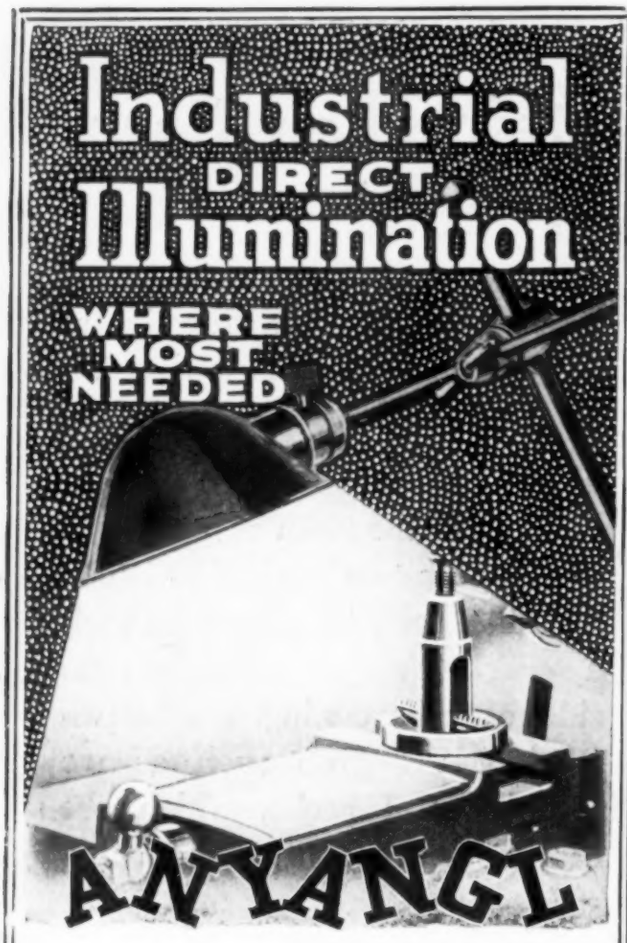


We use the L-B hob for illustration because we actually make a ground rack and then put it into the hob. Consider this rack, taken from a used L-B Hob. It has been ground repeatedly — the tooth section you see now is the same as the tooth section that cut the first gear. It will remain the same until the tooth is ground away.

All cutters are reduced in diameter by grinding, but in a hob the pitch of the tooth is a matter of *length, not diameter. The distance between centers of teeth is not changed by grinding a hob to sharpen it.* This is one of the reasons why practically all of the timing gears on automobile engines are hobbed. It is the most accurate as well as the most rapid method of cutting spur or helical gears.

The LEES-BRADNER Co., Cleveland, O.

"To thread or hob is an L-B job"



ANYANGL Industrial Illumination is proving conclusively in hundreds of the leading shops, mills, and foundries that it will greatly minimize spoilage, eliminate a large percentage of the accidents and at the same time increase production to a standard more nearly equal to daylight production.

The ANYANGL FIXTURE may be attached to any machine, bench or wall, where it is *instantly adjustable* to any position in a complete arc, in either a vertical or horizontal plane. Under its clear, concentrated light, every move of the workman is made sure, safe and speedy. He is not forced to stand in his own light, his eyes are not subjected to a blinding glare, nor is he compelled to strain his eyes in reading a micrometer measurement.

If you are interested in increasing production, reducing spoilage and preventing accidents during the months of minimum daylight, get in touch with your dealer today, or write us direct. An ANYANGL installation is economical in first cost and upkeep.

Miller Saw-Trimmer Co.
Pittsburgh, U. S. A.

Sold by Leading Electrical Jobbers and Dealers

The "Willey" Portable Electric Drill

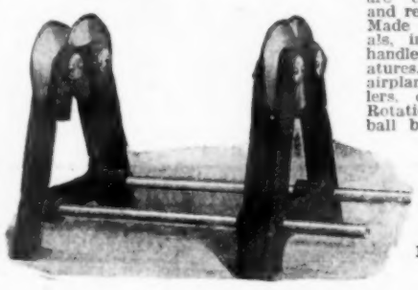
These drills are designed in several sizes and styles to meet every possible problem occuring in their field. Their rugged design and smooth powerful action meet every requirement. Jacobs Chucks are Standard Equipment.

Write for our Drill Catalogue.

FOREIGN REPRESENTATIVES: Buck & Hickman, Ltd., London, Eng. Bevans & Edwards, Melbourne, Australia. Alfred Herbert, Ltd., Yokohama, Japan.

James Clark, Jr. Electric Co., Inc.
521 W. Main St., Louisville, Ky.

The Anderson Ever Ready BALANCING WAYS



are extremely sensitive and require no adjusting. Made of quality materials, in several sizes to handle cutter heads, armatures, polishing wheels, airplane motors, propellers, crank shafts, etc. Rotation discs run on ball bearings.

Full particulars on request.

Anderson Bros. Mfg. Co.
1917 Kishwaukee St.
Rockford, Ill.

Ransom Speed Controller

Automatically takes care of the overspeeding problem. Gives perfect control with speed variation up to 75-100%. Cannot possibly fail as long as the motor runs.

Ransom Mfg. Co., Oshkosh, Wis.

BLACK & DECKER
Portable Electric Drills
Electric Valve Grinders
Electric Air Compressors
The B. & D. "HEX" is a guarantee of quality
THE BLACK & DECKER MFG. CO.
BALTIMORE, MD. U.S.A.

CROCKER-WHEELER MOTORS
"Niagara's Rival for Dependable Power"
A Vital Factor in Uninterrupted Production
Crocker-Wheeler Co., Ampere, N. J.
New York, Boston, Syracuse, Cleveland, Birmingham, Pittsburgh, Newark, New Haven, Philadelphia, Baltimore, San Francisco.

Want Any?
CONTRACT WORK
Any to Let?

A Typical Cooper Hewitt Installation — Note the Absence of Heavy Shadows

Help Your Inspectors Guard the Quality of Your Output

An inspector's ability to detect flaws in the work depends upon his acuteness of vision—and this is largely dependent upon the light you furnish him.

Specialists attached to our district offices will gladly show you how to light your factory better and more economically.

No other system of illumination is comparable with

Cooper Hewitt Light

for the important work of inspection. It has been demonstrated repeatedly that the light from Cooper Hewitt Lamps brings out small dangerous imperfections, such as cracks and flaws in castings and forgings, that might easily escape attention even by daylight and would almost surely be overlooked under any other artificial light.

Imperfections imperceptible to the eye by daylight, have been plainly visible by Cooper Hewitt Light.

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Chicago—618-9 Fisher Building
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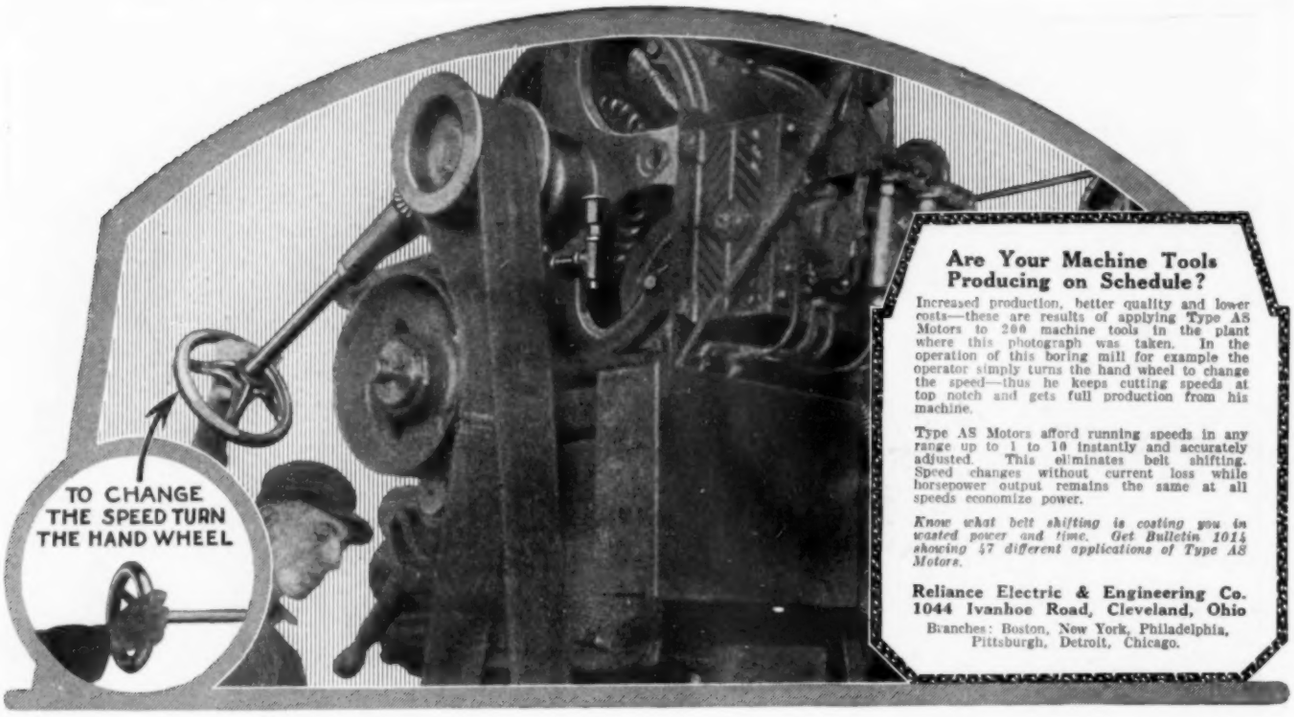
Hoboken—95 River Street

Hoboken New Jersey

COOPER HEWITT LIGHT
BETTER THAN DAYLIGHT
INCREASES PRODUCTION

Los Angeles—Keese Engineering Corp.
Milwaukee—Security Building
Philadelphia—Drexel Building
Pittsburgh—Westinghouse Building
St. Louis—Title Guaranty Bldg.
Syracuse—University Building

CH-35



Are Your Machine Tools Producing on Schedule?

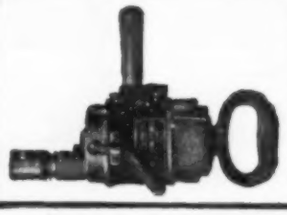
Increased production, better quality and lower costs—these are results of applying Type AS Motors to 200 machine tools in the plant where this photograph was taken. In the operation of this boring mill for example the operator simply turns the hand wheel to change the speed—thus he keeps cutting speeds at top notch and gets full production from his machine.

Type AS Motors afford running speeds in any range up to 1 to 10 instantly and accurately adjusted. This eliminates belt shifting. Speed changes without current loss while horsepower output remains the same at all speeds economize power.

Know what belt shifting is costing you in wasted power and time. Get Bulletin 1014 showing 47 different applications of Type AS Motors.

Reliance Electric & Engineering Co.
1044 Ivanhoe Road, Cleveland, Ohio
Branches: Boston, New York, Philadelphia, Pittsburgh, Detroit, Chicago.

Type A-S Adjustable Speed RELIANCE MOTORS

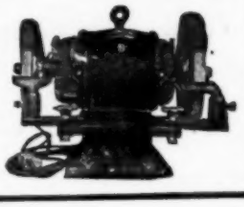


Expensive Equipment Is Not Always Necessary

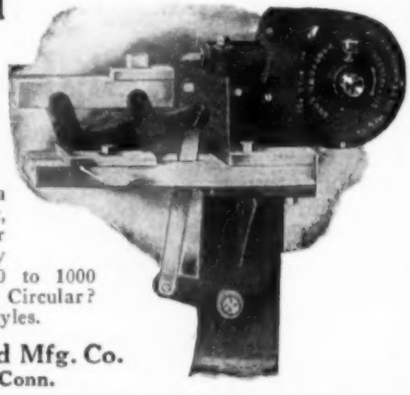
Take U. S. Electric Tools to the work and save four-fifths of the time usually required on each job. Every kind of portable drill, grinder and buffer ready for prompt delivery. Write for Catalog.

THE UNITED STATES ELECTRICAL TOOL CO., Cincinnati, Ohio

New York Office, 50 Church St.
Chicago Office, 549 W. Washington Blvd.
Detroit Office, Marquette Bldg.
Pittsburgh Office, 2138 Oliver Bldg.
Philadelphia Office, Bourse Bldg.
Boston Office, 12 Pearl St.
St. Louis Office, 1956 No. Broadway
Cleveland Office, 215 Meriam Bldg.



Horizontal Multi-Blow Riveting



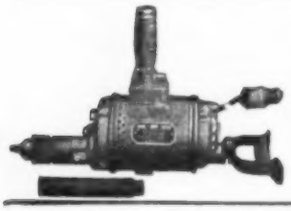
This machine is a wonderfully fast, convenient riveter for long or bulky work.. Strikes 80 to 1000 blows per second. Circular? Other types or styles.

H. P. Townsend Mfg. Co.
Hartford, Conn.

Saniglas
TRADE MARK REGISTERED

Year In, Year Out, The Silent Guardian of Workmen's Eyes.

JULIUS KING OPTICAL CO.
10-12 Maiden Lane, New York

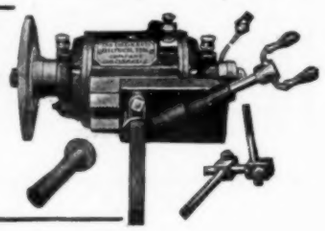


Electric Hand Drills

Made in 12 sizes, ¼ to 2 in. capacities. Hand, Screw Feed, Radials and Bench Drills. Ball and Thrust Bearings.

Tool Post Grinders

¼ to 3 H. P. Weight from 16 pounds up. Free hand feed. Bearings adjustable to wear. Horizontal and vertical feeds. Different types for all purposes. Also Bench and Floor Grinders



Cincinnati Electrical Tool Co., Cincinnati, Ohio
New York Office, 50 Church Street

How do "N-B" Tote Boxes Save Time at Inventory?

Through rendering possible the determination of quantities of small parts *by weighing in the box*. The accuracy of results so obtained is, of course, due to the *uniform weight* of "New Britain" Boxes—*variations not exceeding two per cent.*

While the saving in weighing a few boxes of parts is necessarily small, the economy of time—which might be effected by eliminating needless rehandling of the tons upon tons of product comprising the stock of the average factory—assumes proportions worthy of most serious consideration.

Nesting Type

Stacking Type

However, their greater serviceability at the stock-taking season is but one of many superior characteristics of "New Britain" Tote Boxes. The shaped-for-comfort handle; the unique nesting and stacking features; the greater capacity for withstanding abuse without loss of shape—due to formed hem and firmly welded joints; a construction affording maximum strength with minimum weight—all combine to produce boxes of unusual merit, a quite general recognition of which has resulted in their widespread adoption as standard equipment in hundreds of factories.

We are confident a trial would make you a steady user. Prompt shipment can be made! How many?

The New Britain Machine Company
New Britain, Conn., U.S.A.

WICKES
BLUE PRINT SYSTEM
SAGINAW-MICHIGAN

Who Makes Your Blueprints?

No exceptional skill is required to operate the Wickes Blue Print System. In fact, *any* intelligent man or boy can be readily taught to obtain clean, accurate results. Why "farm" your blue print work out? You can do it at a fraction of the cost in your own plant, with a Wickes Blue Print System.

Literature on request.

1856 **WICKES BROTHERS** 1920
2212 Water Street, Saginaw, Mich., U. S. A.

Builders of
Heavy Duty Plate and Structural Tools: Heavy Duty Engine Lathes, Special Production Lathes and Crankshaft Turning Equipment

Building Pumps With the aid of Air Tools

THE modern pump making plant depends upon air tools to no small extent for economical and rapid production.

Sand Rammers are used to tamp the molds, Air Motor Hoists to handle them and Chipping Hammers and Grinders to trim and clean the castings; air drills and reamers are used extensively in the machining process; and the assembly finds air tools at work seating studs, running up nuts and performing many other operations in a most efficient manner.

Air tools will help *your* production, and you will be well repaid for investigating them. Write to the nearest branch office listed below; you will receive a service that starts with a careful study of your problems and ends only when you cease using tools.

When you write, ask for Catalog 8000

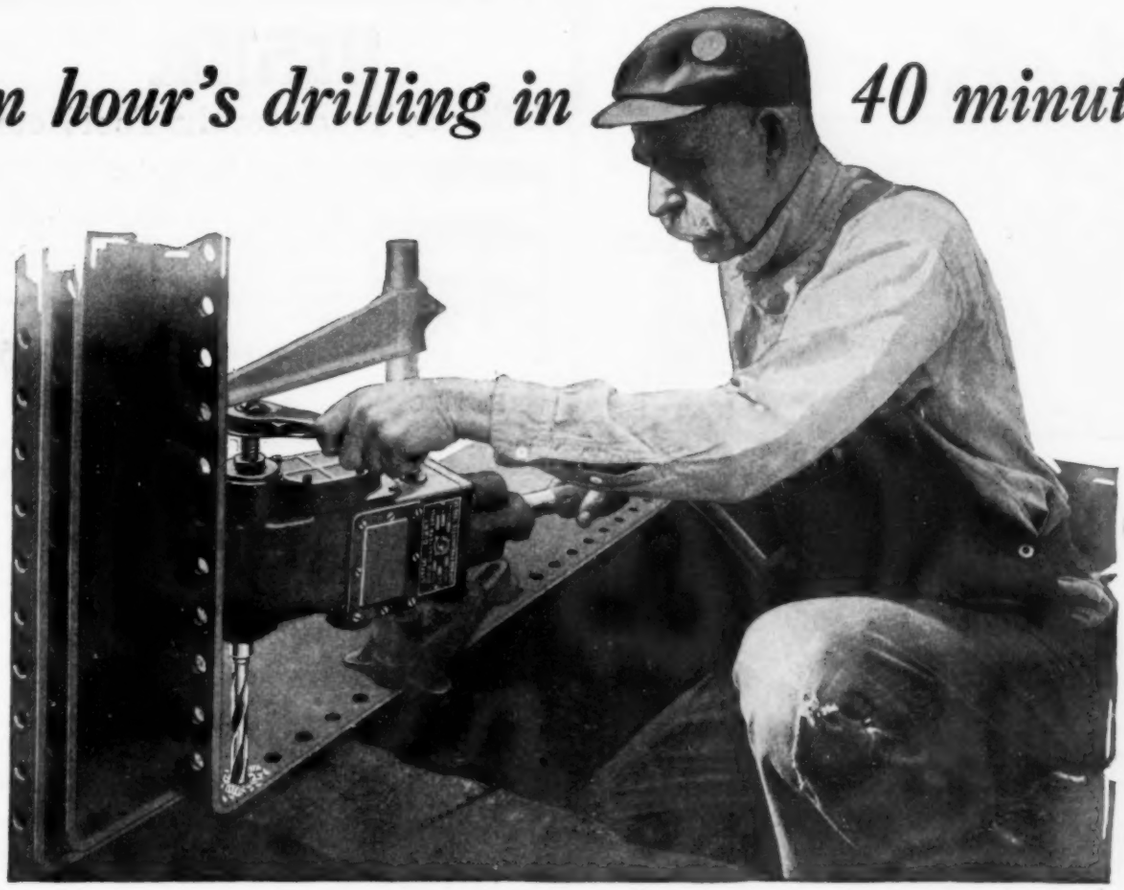
INGERSOLL-RAND COMPANY
11 Broadway NEW YORK

Branch Offices the World Over

148-PT

Little David AIR TOOLS

An hour's drilling in 40 minutes!



Little Giant Close Quarters *gear-driven* **Air Drills have 33% faster drilling speed than drills of the so-called ratchet type. The drive is direct. Their rugged train of stub-tooth gears transmits an unbroken stream of power direct to the spindle. No power, time or efficiency is lost as with the "start and stop" ratchet principle of securing spindle rotation.**

Every user of air power for drilling, tapping, etc., needs this compact tool. It not only proves invaluable for drilling in cramped quarters—its power, convenient control and proportions make it a favorite for any air drill job within its capacity. Two sizes are built in both reversible and non-reversible types.

Prompt delivery from Branch stocks. Ask for instructive Pneumatic Tool Bulletins.

Chicago Pneumatic Tool Company

Chicago Pneumatic Building • 6 East 44th Street • New York

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P 91

BOYER PNEUMATIC HAMMERS · · LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS
CHICAGO PNEUMATIC AIR COMPRESSORS · · VACUUM PUMPS · · PNEUMATIC HOISTS
GIANT OIL AND GAS ENGINES · · ROCK DRILLS · · COAL DRILLS

LITTLE GIANT

The World's Standard *Air Drill*

the tractor builder

In the development of the tractor to its present high state of perfection Thor has played no small part. In drilling and assembling the component parts (as cumbersome and awkward as the assembled product) tractor manufacturers have found Thor Portable Tools an essential requirement for reasons of their speed, capacity for strength and service and freedom from repairs. The bother of installing Thors has never exceeded the task of tapping in on lighting circuits or the pipes of pneumatic systems. A case of making use of existing shop methods instead of altering them.

Thor Universal Electric Drill, illustrated, is designed to make light work of the big job.

Is light and non-stallable up to its full-rated capacity. Either direct or alternating current can be used. It is thoroughly insulated and is equipped throughout with ball bearings.

I'll keep that name Thor in mind when I need any or these tools:

Pneumatic Drills
Pneumatic Wood Boring Machines
Close Quarter Air Drills
Pneumatic Riveting Hammers
Chipping, Calking, Scaling and Flue-Beading Hammers
Hose and Hose Couplings
Pneumatic Grinders
Pneumatic Hoists
Pneumatic Holder-On
Pneumatic Sand Rammers
Electric Grinders
Electric Drills

Independent Pneumatic Tool Co.
Chicago, Ill.
40 Broadway, Westminster, London, S. W. 1
New York Pittsburgh Cleveland Detroit San Francisco
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OTSTEEL

A Strong Truck for the Tool Room

It will save the time of your valuable men by enabling them to keep tools together and by quickly conveying tools and parts from one part of the shop to another. Wood shelves are braced with flat angle steel so that they can't warp or split. Shelves are 9 in. apart and bottom shelf is 8 in. above the casters. Roller bearing casters—riveted on.

Our line includes trucks, chairs, stools, tables, etc. Investigate!

No. 218 C

Angle Steel Stool Co.
Otsego, Mich., and
9 So. Clinton St., Chicago

HYDRAULIC VALVES AND FITTINGS

Watson-Stillman valves are designed to perform their functions with ease and safety. The materials are the best obtainable, and each valve or fitting is tested to a safe overload.

Our line embraces an almost endless number of combinations designed to meet the varied requirements of hydraulic systems.

Write for Catalogs

W-S HYDRAULIC

The Watson-Stillman Co.
42 Church Street, NEW YORK
McCormick Bldg., Chicago

W-S HYDRAULIC

278

DIES
SOLVE THE PROBLEM
CUT DIES AUTOMATICALLY
BY THE KE METHOD
Keller Mechanical Engraving Co.
76 Washington St., Brooklyn, N.Y.

HYDRAULIC MACHINERY

Your every requirement for hydraulic equipment can be met satisfactorily and economically from the extensive H-P-M Line-Presses, Pumps, Accumulators, Valves and Fittings. *Write for catalogs.*

The Hydraulic Press Manufacturing Co.
Mount Gilead, Ohio

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It's Substantially Built— This Sand Blast Machine

The Paxson-Warren Sand Blast Machine is the most efficient made. Every part is accessible. Repairs are few and all wearable piecee easily replaced. Better cleaning—cheaper cleaning of castings. Circular on request.

J. W. Paxson Company, 1021 N. Delaware Ave., Phila., Pa.
Manufacturers' Foundry Equipment and Supplies

BUTLER SELF-CONTAINED **HOEVEL SANDBLAST** AUTOMATIC **MACHINES** Patented

Dustless Sandblast Rooms, Rotary Table, Revolving Barrel, Sandblast Machines, Hose Sandblast and all other Sandblast Equipment.

HOEVEL MANUFACTURING CORPORATION
158 Ogden Ave., Jersey City, N. J.
Controlled by L. O. Koven & Brother
Cleveland Office: 503 American Trust Bldg.

The Balance of the Horizontal and Vertical Reciprocating Masses and Movements is so Exact in

Sullivan Angle-Compound Air Compressors

that **a coin will stand on edge** on this machine, while running at full speed without the foundation bolt nuts.

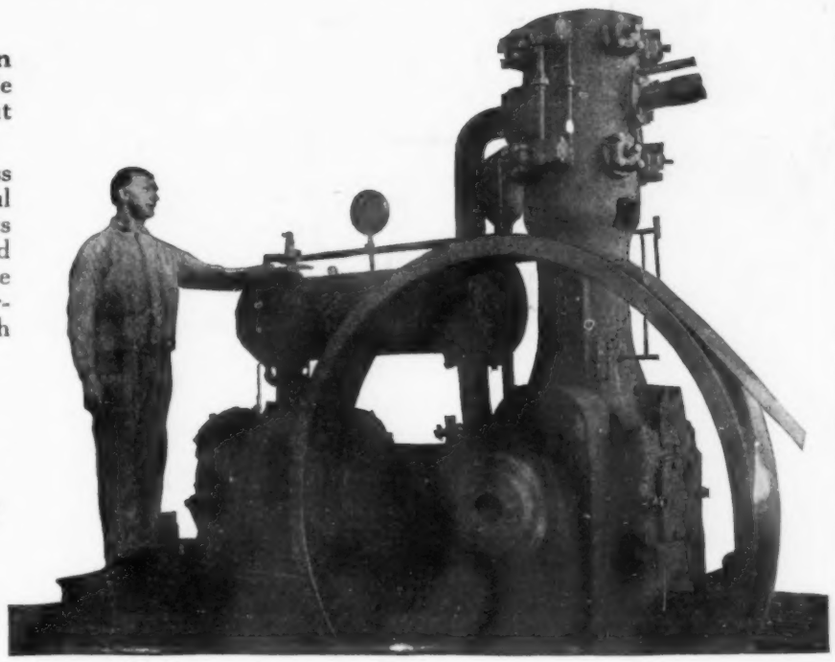
This balance and smoothness of operation saves for useful work power lost in other types in overcoming friction and vibration. It saves floor space and foundation cost and permits safe operation at high speeds.

Send for New Bulletin 750-S

Prompt deliveries in capacities from 450 to 2600 cu. ft.

Sullivan Machinery Company
122 S. Michigan Avenue
Chicago

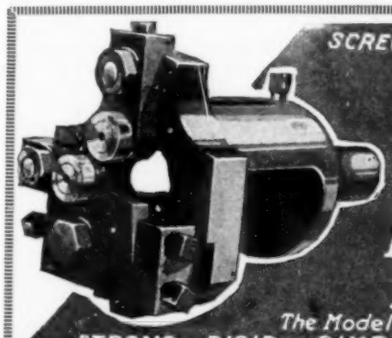
BALANCE



PANGBORN
HAGERSTOWN, MD. P. O. BOX 855

PANGBORN CORPORATION ALL-WAYS SERVICE AND ALWAYS HAGERSTOWN, MD.

Hygienic, Automatic
SAND-BLAST EQUIPMENT
Will operate in your Plant
WITHOUT DUST
and no detriment to other machines.
"Pangborn" Service makes Sand-Blasting Profitable



SCREW PRODUCT OF
QUALITY
WITH
WATSON
TANGENT CUT
BOX TOOLS
The Model "D" Look it Over
STRONG—RIGID—SIMPLE—COMPACT

All movable parts mounted on solid one-piece steel body insuring strength and rigidity. Extremely simple to set—all movable parts travel in straight lines assuring proper bit clearance and support of work for all diameters. Made regularly in 4 sizes for turning diameters from ½-in. to 2½-in. *Write for complete catalogue.*

WATSON MFG. CO., TOLEDO, OHIO

KELLER-MASTER

KELLER-MADE MASTER-BUILT

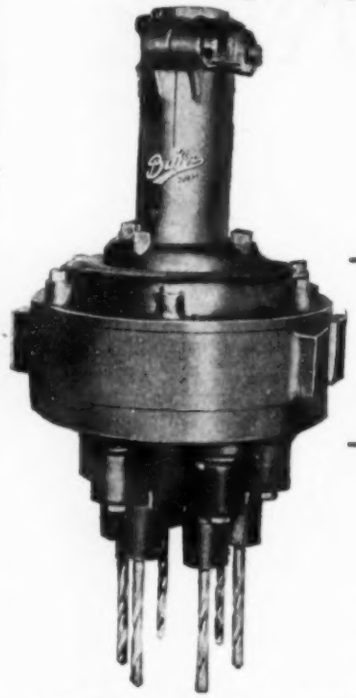
Experience
—has been the Master Designer of "Keller-Master"

Riveting Hammers
Chipping Hammers
Scaling Hammers
Jam Riveters
Staybolt Riveters
Rivet Busters
Holders-On
Sand Rammers
Valveless Drills
Corliss Valve Drills
Accessories

Complete Catalog on Request

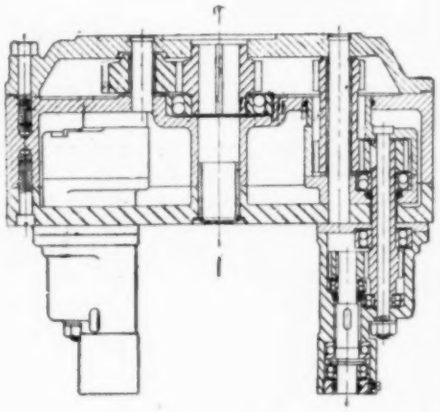
KELLER
PNEUMATIC TOOL COMPANY
GRAND HAVEN, MICHIGAN
BRANCHES EVERYWHERE

A Multiple Spindle Drilling Machine Minus the Cost



The new BUHR Fully Adjustable Drill Head will do 80% of the work now performed by fixed center heads.

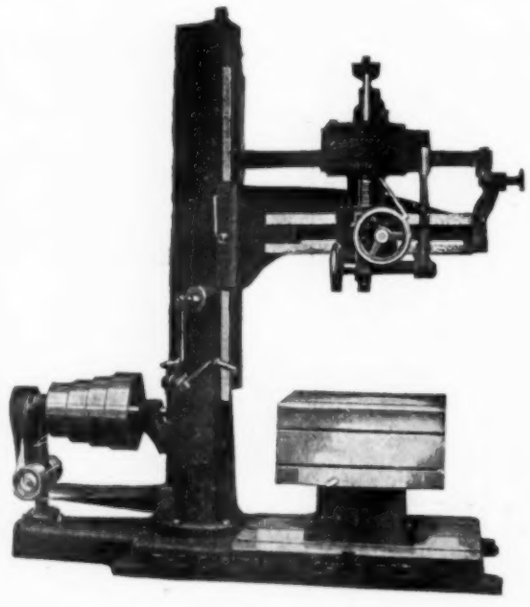
The Buhr DRILL HEAD



This drill head is in a field by itself in that it is fully adjustable. The arm can be rotated or moved in and out. Set ups can be obtained in large circles, square, rectangular or staggered positions. Spur gears and ball bearings throughout.

NELSON-BLANCK MFG. CO., Detroit, Mich. *New York Office* Grand Central Palace

The Belt Drive Improves the Finish



Accurately balanced running members and belt drive imparts a finish to the work that cannot be excelled. But smooth action and accurate operation are prime factors in the

CARLTON
Speedy, Sensitive
Radial Drill

Added to these features you get *speed*. The operator can instantly obtain spindle speeds from 300 to 1170 r.p.m.

Lower cost per piece must be your manufacturing slogan and the Carlton will enable you to live up to it.

The details are convincing—get them.

The Carlton Machine Tool Co., Cincinnati, Ohio

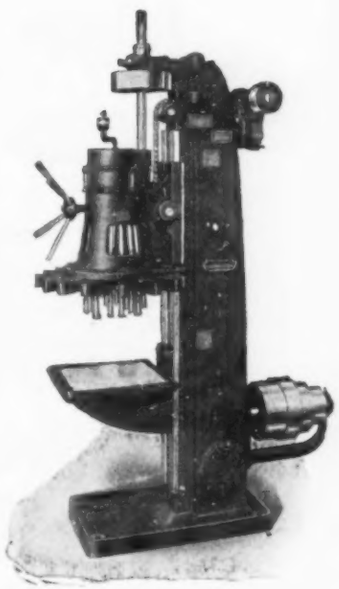
HARRINGTON Multiple Spindle Drills

Practical methods are employed in every successful machine shop.

Practical machinery is employed in these institutions with the result that the work is turned out at less cost than by unpractical shops.

Since DRILLS are important in machine shops it is well to adopt *practical* drills.

Harrington Multiple Spindle Drills are the correct solution. They reduce drilling operations to a minimum. They save floor-space and man-power. They have ample head areas and are easy to operate. Built ruggedly and can have large number of drills for their size.



Write for Bulletin today.

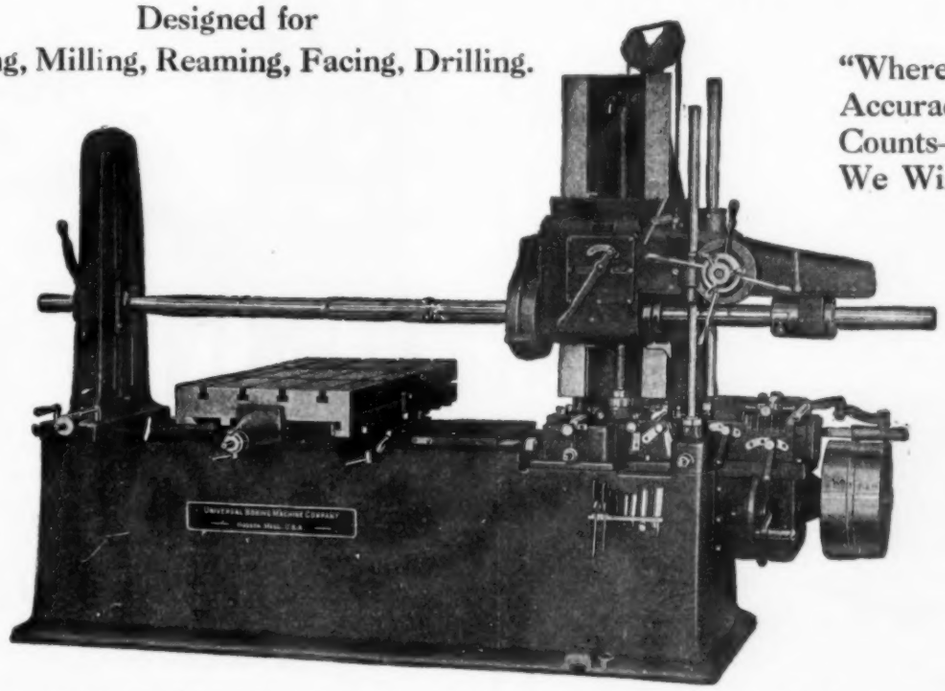
EDWIN HARRINGTON, SON & COMPANY, Inc.

Philadelphia, Pa.

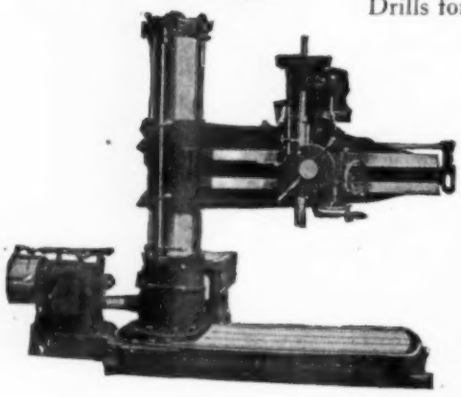
Universal (Horizontal) Boring Machine

Designed for
Boring, Milling, Reaming, Facing, Drilling.

"Where Accuracy Counts— We Win"



UNIVERSAL BORING MACHINE CO., Hudson, Mass.



FOSDICK DRILLS

cut expense and increase output

Fosdick 21, 25 and 30-inch Upright Drills have powerful frictions which transmit six times more power to the spindle for heavy tapping, than most uprights of equal weight.

Power consumption is minimized by the reduction of resistance to all moving members—which are accurately constructed—rendering a perfect alignment.

Fosdick 2 to 6-Foot Radials

are convenient, heavy duty machines of great adaptability and unusual economy. Here is hoping that your New Year will be bright and prosperous. Fosdick Drills for greater economy in 1921.

Write for the descriptive Circular.

The Fosdick Machine Tool Company

Cincinnati, Ohio, U. S. A.

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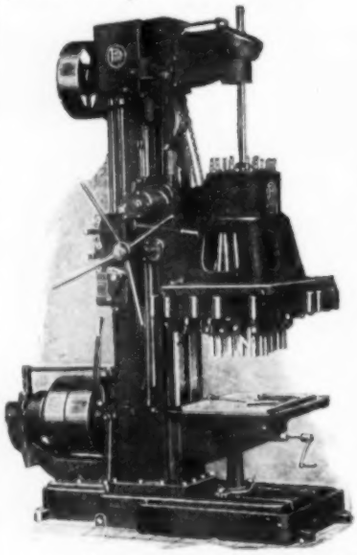
Overcome Your Drilling Problems

BY SPECIFYING A "FOX"

Every manufacturer should know the cost-cutting possibilities of Fox Multiple-Spindle Drills on work now in their shops.



Our Trade Mark!

Look for it when buying drills.

Multiple Drills

with a reputation for power, speed and accuracy, coupled with a wide range of adaptability and economy are well worth investigating.

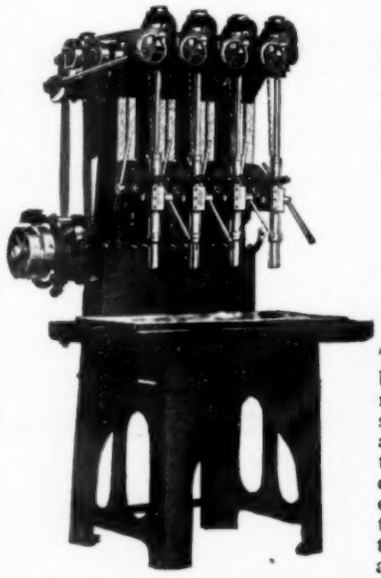
Write Today!

Fox Machine Co.

Jackson, Mich.

Formerly of Grand Rapids, Mich.
New York Office:
Grand Central Palace

D-22—"WHERE ACCURACY COUNTS WE WIN"



Speed Up Your Drilling

You can drill your small holes more quickly and more efficiently with the

Henry & Wright

The special drive and ball bearings give the necessary high spindle speed. Every control and every feature of this machine has been designed with a view of increasing production with less effort on the part of the operator.

Your one aim in buying a drilling machine should be greater output per spindle. You get it in Henry & Wright Drilling Machines. **Our Catalog contains some interesting drilling data. Send for it.**

The Henry & Wright Mfg. Co.

Hartford, Conn.

New York Office: 136 Cedar St.

OVER-SEAS REPRESENTATIVE

ALMACOA ALLIED MACHINERY COMPANY OF AMERICA ALMACOA
51 CHAMBERS ST. NEW YORK, U.S.A.

Paris, Turin, Zurich and Barcelona

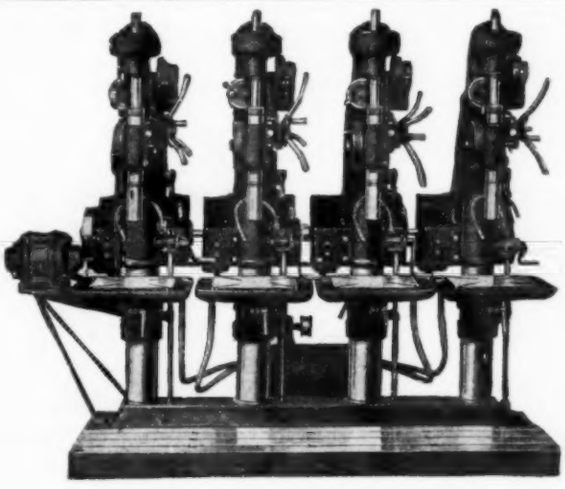
CLEVELAND

RANGE

The horizontal arm can be furnished in lengths from 6-ft., 0-in. to 20-ft., 0-in. inclusive and may be arranged with 6-ft., 0-in. vertical adjustment or with a stationary wall back. The drive may be by belt thru three step cone pulley or direct connected motor drive. The feed can be lever, handwheel or automatic. The handwheel feed includes the lever feed and the automatic feed includes both handwheel and lever feeds.

Write for our No. 4 Bulletin which gives complete description of these machines.

THE CLEVELAND PUNCH & SHEAR WORKS CO.
Main Office & Works · CLEVELAND, OHIO
PITTSBURGH - CHICAGO - PHILADELPHIA - NEW YORK



THERE are no time wasting, trouble making belts on ALL GEARED and SELF OILED GANG. Bigger production is the result. Ask for the Catalog.

Will you accept our best wishes for a bright and prosperous New Year?

Barnes Drill Co., Inc. 1907
830 Chestnut St., Rockford, Ill., U. S. A.

AGENTS FOR GREAT BRITAIN: Burton, Griffiths & Co., Ltd., London, E. C. FRANCE: R. S. Stokvis & Fils, Paris. JAPAN: Roku-Roku Shoten, Tokyo. ITALY: Alfred Herbert, Ltd., Milan. NEW SOUTH WALES: R. J. Scrutton & Co., Sydney. BELGIUM: G. & F. Limbourg Freres, Brussels.

GET THE BEST—
It Saves You Money

Real,
Genuine
Satisfactory
Service

starts in the designing: there is where every little detail is studied with a view to producing a finished machine that will show real results in quality and quantity production.

No. 0 AVEY—Bench or column. Capacity 3/8 in. Speeds up to 3500. 1 to 6 spindles. Overhang 6¼ in.

Avey BALL BEARING DRILLING MACHINE

Operating Adjustments Simple, Direct and Positive. Power and Speed to Suit the Job. Extreme Accuracy. Features that Produce Results.

Avey Drilling Machine Co.
Cincinnati, Ohio

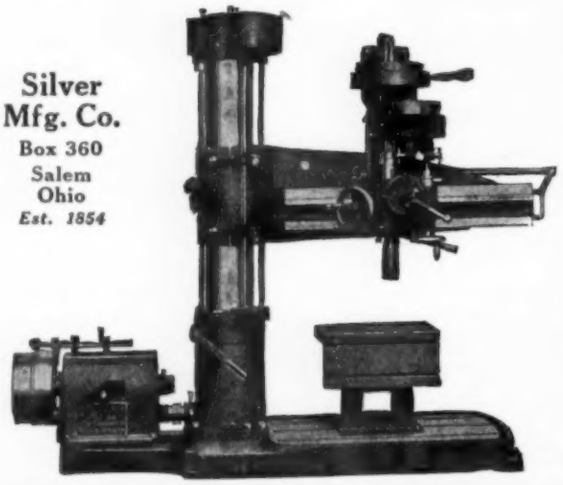
No Spring nor Vibration

No matter whether the arm be high or low, the Silver 3½ ft. Radial is absolutely vibration-proof. The extra-wide bearings of the arm on the column, at top, bottom and center, combine perfect freedom of movement, with rigid support.

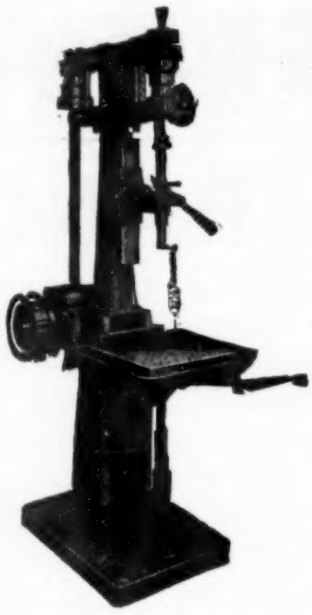
The heavy ribs of the inner column give an unshakeable "stiffness" in resisting severe stress.

Every operator is won over by "Silver" convenience. Our bulletin tells why.

Silver Radials



Silver Mfg. Co.
Box 360
Salem
Ohio
Est. 1854



Features

Quick Change Speed
Change in 2 seconds

Most Efficient Drive
No belt troubles

Safety First
All parts protected

Heaviest Sensitive Drill Made

All Ball Bearings

ITS A TRADE MARK SIPP

Two Seconds Is Ample Time to Change Speed on A

Sipp Quick-Change-Speed Drill

The reason why efficient speeds are not used on most drills is that it is so much trouble to change the operatives won't do it. You can change speed on a SIPP in two seconds by simply shifting a lever. That's one reason why *it pays* to use a SIPP.

Write for Bulletin No. 4

THE SIPP MACHINE COMPANY
Erie R.R. Ave. **Paterson, N. J.**

BICKNELL-THOMAS
Reversing Tapping Attachment

It saves time on drill press operations because it eliminates necessity of reversing the spindle. When tap has been driven the desired depth, raising the spindle reverses the tap—meanwhile press is still running at full forward speed.

This attachment is provided with our friction chuck which can be set so that in case the tap binds in the hole or taps to the bottom of a hole the friction will slip instead of the tap breaking.

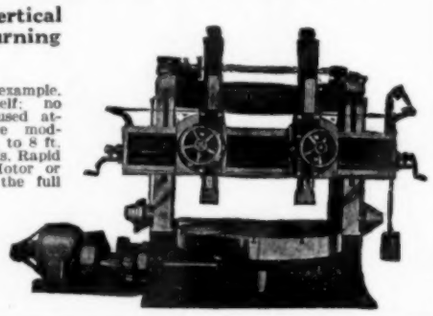
BICKNELL THOMAS CO.
Greenfield, Mass., U. S. A.
Pacific Coast Agents—Charles A. Dowd Sales Co., San Francisco.
British Agents—Geo. W. Goodchild & Partners, London.

Vertical Boring and Turning Mills

handle a wide variety of work not expedient or possible on other machines—particularly the unusual, the irregular.

BICKFORD Vertical Boring and Turning Mill

is a finely developed example. Complete within itself; no costly and seldom-used attachments, therefore moderately priced. 4 ft. to 8 ft. Single or double heads. Rapid power traverse. Motor or belt driven. Get the full catalog description.



H. Bickford & Co.
Lakeport, N. H. U.S.A.

It's Hard To Break A Tap On The "Tuttle"

Tuttle Tapping Machines are serviceable tools for quantity productions of accurate work. Although sensitive machines they will stand the abuse of unskilled operation. "Tuttles" save taps and temper. Made in two styles: for hand lever and foot lever operation.

Our Booklet gives details of both machines. Send for your copy now.

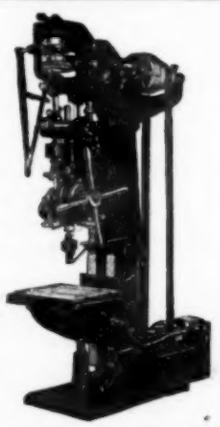
EVANS STAMPING & PLATING CO., Taunton, Mass.

TURNER TURRET

It is a great time saver. Completes a series of operations at one setting. Each spindle carries a different tool. Can be operated by ordinary workman at full capacity and with extreme accuracy.

We have been in business 70 years, so our machines must be all right.

We also manufacture the Quint Turret



Turner Machine Company
Danbury, Conn.

Foreign Representatives: Burton, Griffiths & Co., Ltd., 64-70 Vauxhall Bridge Road, London, for Great Britain; and Allied Machinery Company of America, with Offices in France, Belgium, Switzerland, Italy, Spain, Portugal.

the first to reach

10,000 R.P.M.

This Leland - Gifford Drilling Machine was the first to attain a 10,000 R.P.M. speed. They were the pioneers and still maintain their supremacy. They drive drills to their capacity and yet reduce drill breakage.

Write for complete details of our styles and sizes.

Leland-Gifford Co.
Worcester, Mass.

LELAND-GIFFORD

Submerged Drilling Ever Try This Method?

Work Revolves

Drill Always Lubricated

Quadrupled Production

Longer Drill Life

A method that is a complete departure from the present one is established by the Hjorth Submerged Drilling Attachment. It prevents heating of work, eliminates wear of cutting edge of drill and keeps chips and shavings from adhering to drill. Drill is self centering in socket, drill holder which accommodates and holds firmly any drill ¼ in. to 1½ in. size. Ordinary lengths of drills up to ⅞ in. diameter can be lowered into holder and thereby shortened if required. The attachment can be raised up and down to accommodate the size of work. This Attachment is for use on any make of upright drilling machine.

Ask for fuller details.

HJORTH LATHE & TOOLS CO.
Office: Boston, Mass. Works: Woburn, Mass.

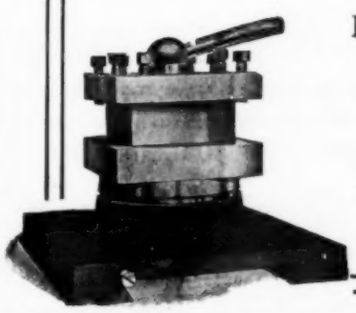
Save with a Phoenix Turret Tool Post

The Phoenix Four Tool Turret Tool Post is designed to go on the lathe carriage in place of the regular tool block.

It carries regular tools for turning, threading, etc.

The Post is subject to all the movements of the carriage. The tools are held rigid.

You can save time on operations and save investment in a turret lathe by using the Phoenix.

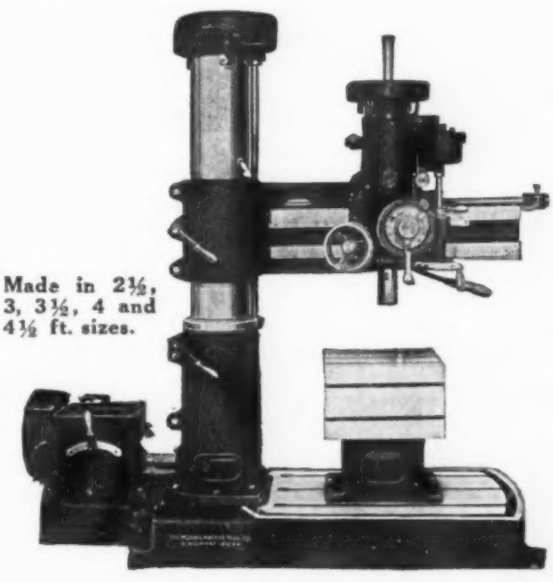


Phoenix Mfg. Co.
Eau Claire, Wis.

W. L. Harrison,
Representative
433 Marquette Bldg.,
Chicago, Ill.

Send for the Morris Radial Catalog

It describes in detail this down to the minute drilling machine.



Made in 2½, 3, 3½, 4 and 4½ ft. sizes.

The Morris Machine Tool Company
Cincinnati, Ohio
Niles, Bement, Pond Co., 111 Broadway, N. Y.

B.C. AMES CO.
WALTHAM MASS. U.S.A.

Filing Perfectly Straight and True Surfaces to Any Desired Angle

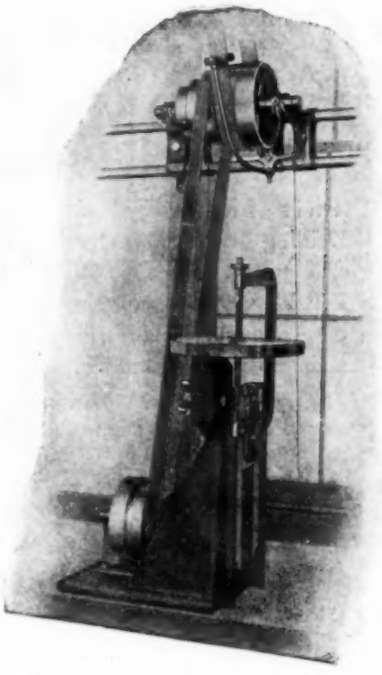
The Ames Bench Filing Machine does this sort of work perfectly. You will find it highly efficient and economical for dies, jigs and template work.

The table is nine inches in diameter, and is adjustable and graduated.

The files are 8 inches in length, with holes in both ends, and are used just like a hacksaw blade.

The machine is furnished complete with countershaft and one set of files.

Write us for prices and delivery.



B. C. Ames Company, Waltham, Mass., U. S. A.

THE WESTERN
***(low hung drive)* Radial Drill**

Driven by a set of gears at the **lower** end of the spindle, close to the work. This feature practically eliminates all torsional strain and vibration. It permits deeper, heavier cuts to be made faster and better.

Literature on request.

Western Machine Tool Wks., Holland, Mich., U.S.A.

HAMMOND RADIAL DRILLS

Reduce Drilling and Tapping Costs. How? By eliminating the expense of time-consuming set-ups. They are portable within a circle of four feet.

See illustration in next week's ad.

The Hammond Manufacturing Co.
Cleveland, Ohio

The CHARLES L. JARVIS CO.
Gildersleeve, Connecticut

Manufacturers of
High Speed Tapping Devices
for Drilling, Reaming, Counterboring, Tapping

The Mueller Machine Tool Co.
Cincinnati, Ohio

Radial Drills and Lathes
Write for particulars

Minus Frills and Furbelows

Nothing to complicate operation nor use up power on the
Pedrick Column Boring Machine
Simple in design—sturdy and accurate under strain. **Learn its** many economy features by writing for your copy of **the Bulletin.**
PEDRICK TOOL AND MACHINE CO.
3637 N. Lawrence St., Philadelphia, Pa.

Highest Efficiency—Utmost Economy

"Hole Hog" Multiple Drillers and Borers increase the output and reduce production costs. Save in every direction. Increase the capacity of your plant by using "Hole Hogs" instead of building an addition. Tell us your needs.

MOLINE TOOL COMPANY **Moline, Illinois**

Sidney Service Always

Lathes designed and built to give the right kind of service.

Lathes sold with advice. Particulars on request.

The Sidney Machine Tool Co.
Sidney, Ohio, U. S. A.

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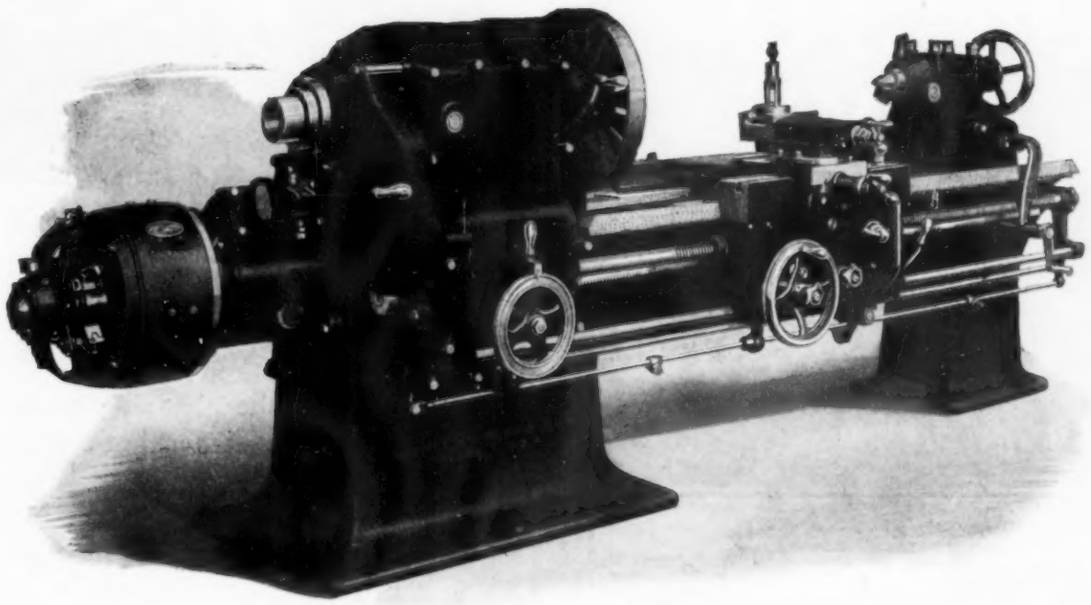
BE SURE AND SPECIFY
"WILMINGTON FIBRE"

WILMINGTON FIBRE SPECIALTY CO., Wilmington, Del.
BRANCH OFFICES "EVERYWHERE"



Ryerson-Conradson 22 in. Selective Head Engine Lathe.

Direct Motor Drive

Eliminates Power Transmission Losses

Ryerson-Conradson Machine Tools

LATHES
RADIAL DRILLS
MILLING MACHINES
PLANERS

Belts, tension idlers, chains drives and complicated motor mountings have been eliminated on the Ryerson-Conradson Lathes.

The Motor is bolted to the bed, the armature shaft connected directly to the primary shaft, driving the spindle through herringbone gears, thus providing smooth continuous operation.

There are many other advantages in the Ryerson-Conradson Direct Motor Drive Arrangement. Before purchasing your next lathe —investigate. It will pay you.

Write for Bulletin 1301

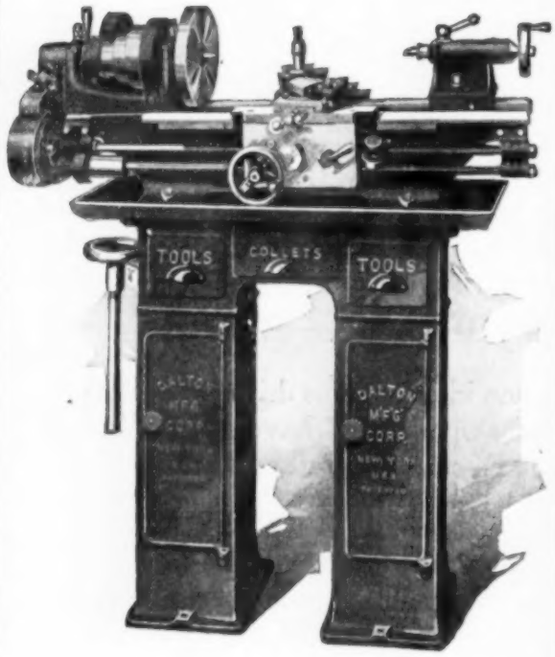
JOSEPH T. RYERSON & SON

MACHINERY

CHICAGO ST. LOUIS DETROIT BUFFALO NEW YORK

"DALTON SIX" TYPE B-6

The Small Lathe for the Big Job



FULL CABINET HIGH LEGS

For the tool room or experimental department the **"Dalton Six"** has no equal.

Actual Swing - - 8¼ inches
Between Centers 18½ inches
Collet Capacity - ¾ inch

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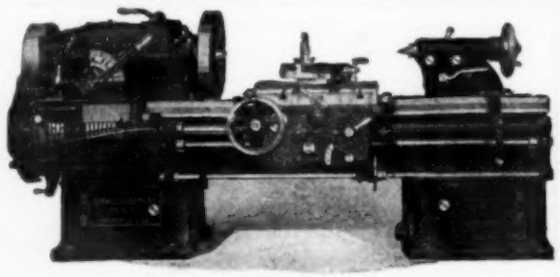
DALTON
MANUFACTURING CORPORATION
Sound Beach, Connecticut, U. S. A.
Cable Address, "Aledal New York"
Also Manufacturers of Type B-4 Lathes



A Lathe for the Big Jobs

Here is a lathe that is powerful enough to back the heaviest cuts possible with high-speed steel. It has all the refinements that have made G-K Lathes famous and its sturdiness is beyond question.

Your inquiry brings full details of this economical producer.

The Greaves-Klusman Tool Co.
Cincinnati, Ohio, U. S. A.

Send for this Lathe Circular No 104

Axelson Lathes
Heavy Duty
Quick Change Three Step Cone, Double Back Geared, Screw Cutting Engine Lathes
AXELSON MACHINE CO.

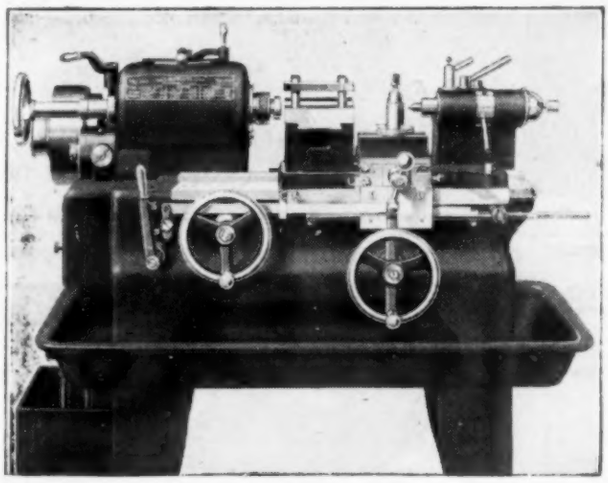
Lathe Information

—Contains interesting news for Lathe Buyers

Complete specifications of Axelson 16-in., 18-in. and 24-in. Heavy Duty, quick change, three step cone, double back gear, screw cutting engine lathes are given in this circular. Gives full information. Write for your copy.

AXELSON MACHINE CO
Los Angeles, California, U.S.A

"SUNDSTRAND"



9-in. Manufacturing Lathe

If your machine work includes the usual preponderance of short length parts of comparatively small diameter, with speed and accuracy equally important, you will appreciate this sturdy little "short-bed" manufacturing lathe.

Separate V's permit the carriage to travel in front of the tailstock. All-geared type headstock is equipped with adjustable radial thrust bearings and operated by a sensitive friction clutch which automatically controls the friction brake. Controls are conveniently located and carriage is drilled for taper attachment which may be added at any time. Nine spindle speeds and four feeds with adjustable automatic stops are provided and the hole through the spindle is $1\frac{11}{32}$ in.

Literature on request.

ROCKFORD TOOL COMPANY, Rockford, Illinois

FOREIGN AGENTS: Casamitjana Hermanos, Aparado 503 Barcelona, Spain; A. A. Jones & Shipman, Ltd., New Century Works, Leicester, England; R. S. Stokvis & Zonen, Ltd., Rotterdam, Holland (Belgium and France); Rudel-Belnap Machinery Co., 137 McGill St., Montreal, Quebec, Can.; Aktiebolaget Rylander & Asplund, Stockholm, Sweden; M. Mett Engineering Co., Petrograd, Russia; The Swiss Machinery Import Co., Ltd., Zurich, Switzerland.

Premier Bench Lathe

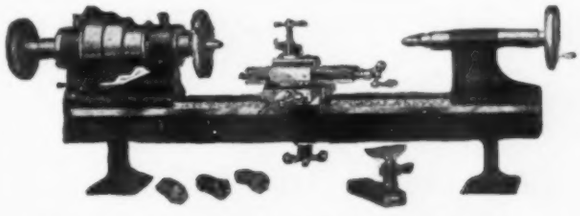
Wherever an electric light socket is available, you can set up the "Premier" without a special base. Its sturdy design makes extra heavy cuts possible; its extreme accuracy makes it ideal for experimental work.

Set it up anywhere

Weight 200 lb.
Length 40 in.

Write for complete details—today.

National Premier Machine Tool Co.
1512 Lakeside Ave., N. E., Cleveland, Ohio



Elgin Precision Bench Lathes

represent one of the largest lines of tools of their kind on the market. They are made in many different styles and sizes, adaptable to all conditions.

Write for catalog.

ELGIN TOOL WORKS, Elgin, Ill., U. S. A.

You Want an AWT Bench Lathe

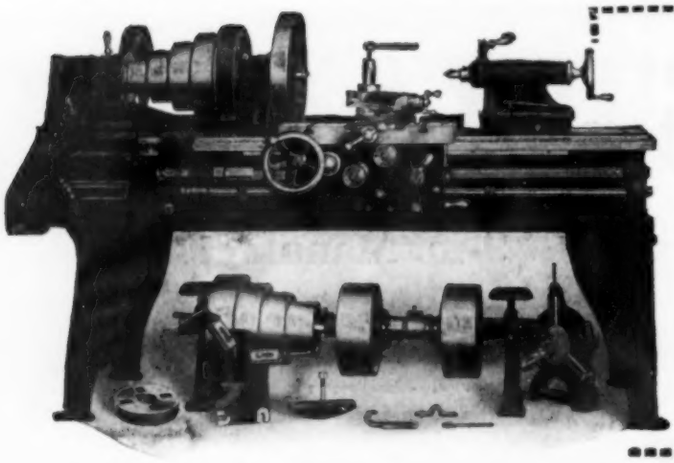
Can be adapted to numerous manufacturing operations done accurately and economically with the various interchangeable attachments. These uses and methods are not generally known but we are specialists in just this line.

Let us know your problems.

THE WADE-AMERICAN TOOL CO.
49-59 River St., Waltham 54, Mass.

Successors to W. H. Wade of Boston; American Watch Tool Company of Waltham

Henry Prentiss & Co., New York, Boston, Rochester, Syracuse, Buffalo, Scranton; Sherritt & Stoer Co., Philadelphia; Moteh & Merryweather, Cleveland, Cincinnati, Dayton; National Supply Co., Toledo, Ohio; Chas. A. Strelinger & Co., Detroit; Machineshop Equipment Corporation, Boston; Eccles & Smith, San Francisco. *Foreign:* Chas. Churchill & Co., Ltd., London, Birmingham, Manchester, Glasgow; Stokvis & Zonen, Inc., Rotterdam.



Made Any Resolutions?

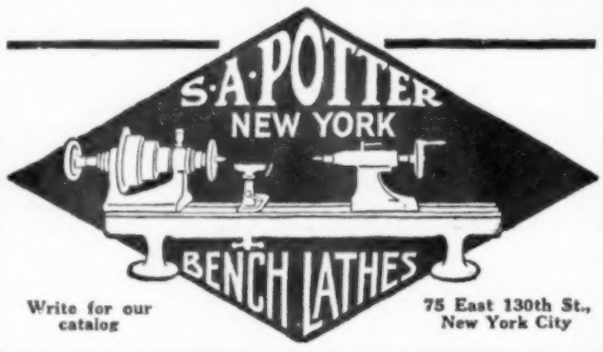
Here's one that we suggest—resolve that whenever you get a hint as to a better way to do what you are now doing—give it a hearing!

For instance, if you read that "Champion" Lathes will actually save you money in operation and maintenance—and that manufacturers around the country are willing to "tell the world" about "Champion" record—*why not look into it further?*

Resolve to send for the "Champion" catalog—today!

CHAMPION TOOL WORKS
4955 Spring Grove Ave., Cincinnati, Ohio

Precision Bench Lathes



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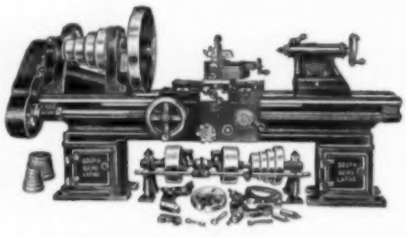
THE TILTED TURRET
A CLEAR TRACK TO THE STOCK

ACCURATE *and* PRODUCTIVE
15 years of satisfied users.

Ask the User *Send for Catalog*

WOOD TURRET MACHINE CO.
BRAZIL, INDIANA, U.S.A.

SOUTH BEND LATHES



Made in eight sizes, 9-in., 11-in., 13-in., 15-in., 16-in., 18-in., 21-in., and 24-in. swing, with beds from 3 ft. to 16 ft. in length. Straight or gap bed.

South Bend Lathes have been on the market 14 years.

Send for New Catalog No. 60

South Bend Lathe Works, South Bend, Ind.
422 E. Madison Street

HERMES TRACING CLOTH

Cut to Order and Already Printed with Border and Corner Title

No waste in cutting. Tracings need not be cut separately. "Hermes" Cloth will not crack.

It is not effected by erasures.

Most economically ordered in flat sheets cut to size with printed border and corner title. Also furnished plain in 24 yard rolls, 30, 36 and 42 inches wide. Send for testing sample and prices on sizes cut to your requirements.

SPAULDING-MOSS COMPANY
42 Franklin Street, Boston, Mass.
Dealers write for proposition.

Libby Turret Lathe

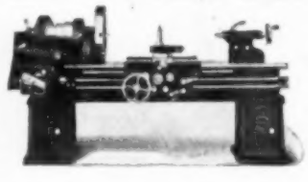
A superior machine made by a man who is familiar with machine shop requirements. Machine is strong, powerful and rigid. Adaptable to entire range of heavy bar and chuck work. Let us give you full details.

International Machine Tool Co. **Indianapolis, Ind.**

CINCINNATI LATHES

Cincinnati Lathes are built in sizes from 16 in. to 28 in. inclusive, either cone type or geared head, for belt or motor drive. They are accurate, rapid, easy to operate, and economical in upkeep. Write for information. Cable Address: Cintilathe.

THE CINCINNATI LATHE & TOOL CO.
OAKLEY, CINCINNATI, OHIO, U. S. A.



The Accurate Lathe at a Moderate Price.

10 in. to 30 in. Swing.

The Monarch Machine Tool Co.
107 Oak St., Sidney, Ohio

GREAVES LATHES

Built with three step cone, double friction back geared head and also single pulley drive geared head. Three sizes—24, 27 and 30 in. Ask for detailed description.

THE GREAVES MACHINE TOOL CO.
CINCINNATI, OHIO.

Handy—Speedy—Accurate

THE S. & C. BENCH LATHE

7-in. swing, 18 in. between centers, compound slide rest. Attachments furnished for screw cutting, grinding, milling, etc.

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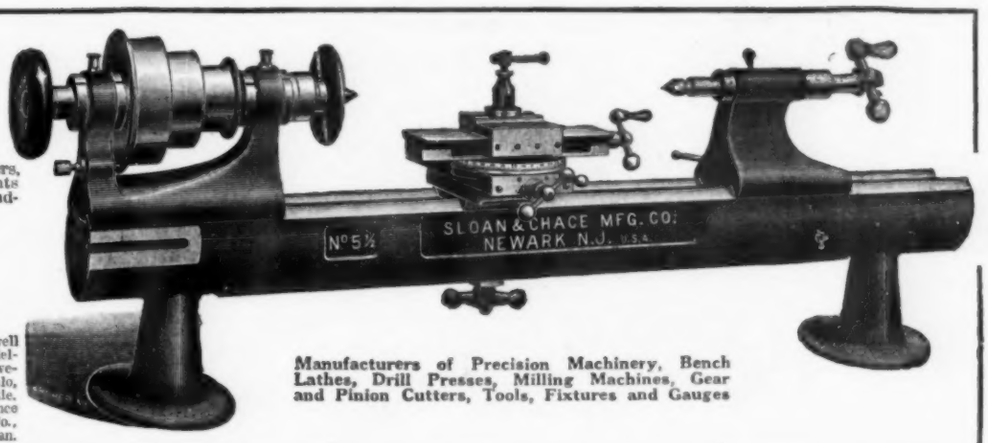
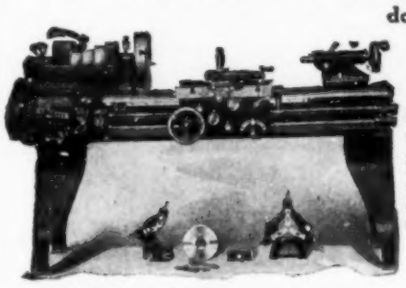


Manufacturers of Precision Machinery, Bench Lathes, Drill Presses, Milling Machines, Gear and Pinion Cutters, Tools, Fixtures and Gauges

ECONOMY 14 Inch Swing

double backgeared Quick Change Engine Lathe



Specially designed to meet modern demands for a small heavy duty lathe to handle rapid production.

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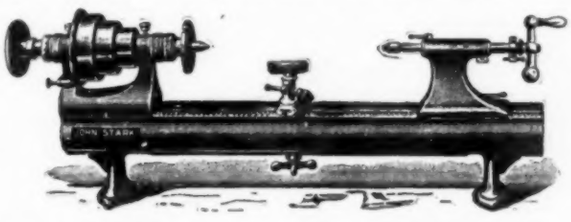
ROCKFORD LATHE & DRILL CO.
Rockford, Illinois

STARK LATHES AND TOOLS

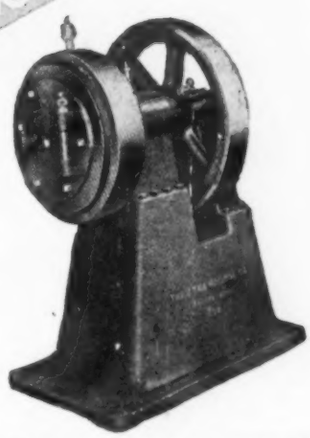


Stark Attachments are like Stark Lathes—true precision tools; adequate, rigid, strong. They maintain their accuracy.

Send for new illustrated bulletin.

STARK TOOL CO., Waltham, Mass.
Established 1862

ETNA



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You'll find this Etna Swaging Machine can be relied upon for accurate dimensions. Its brute strength, with 3000 blows per minute, is practically unlimited, and quality results can be maintained on the heaviest swaging of solid stock or tubing. We make sizes from ¼ to 4½ inches.

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Why not? You have not had a chance to repair them and the terrific strain of 24-hours-a-day operation has not helped them any.

UNDERWOOD SERVICE

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Send it along—day or night. Had "Helpful Hints?"

H. B. Underwood Corp.
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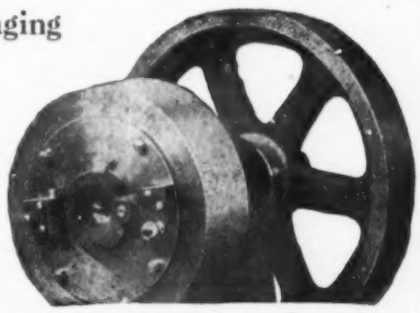

Metal reduced the Dayton Way stands longer in service. Our fully illustrated catalog describes methods. Get it.

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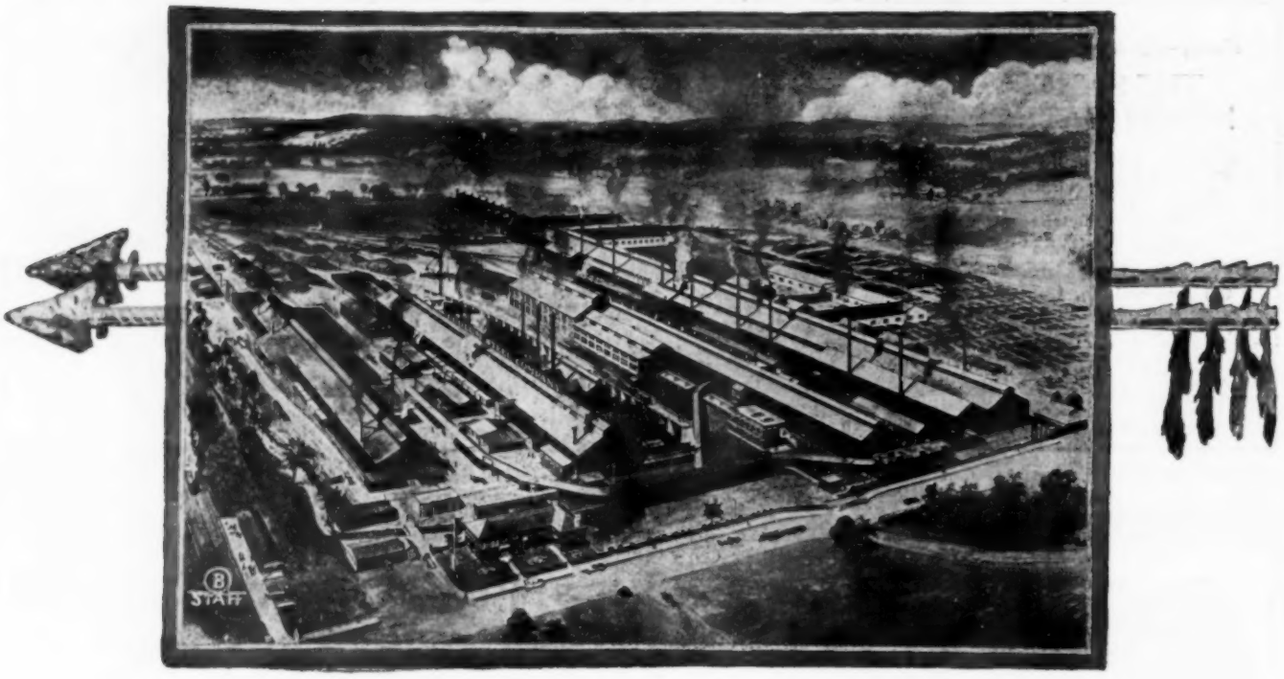
Excelsior Plant—Successor to Excelsior Needle Company

Coventry Swaging Co., Ltd., White Friars Lane, Coventry, England, Agents for Great Britain. Fenwick Freres & Co., 8 Rue de Rocroy, Paris, France, Italy, Belgium, Spain, Portugal and Switzerland.



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Uniform and Dependable

This is the plant in which have been developed and perfected Seminole, the unbreakable chisel steel; Mohawk Extra, the high-speed steel that cuts big, red-hot chips; Silcrome, the steel that will not corrode when heated; non-shrinking, ball-bearing, and permanent magnet steels; etc.

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Ludlum steels have an unexcelled quality of absolutely controlled analysis.

Ludlum is the steel that reduces costs.

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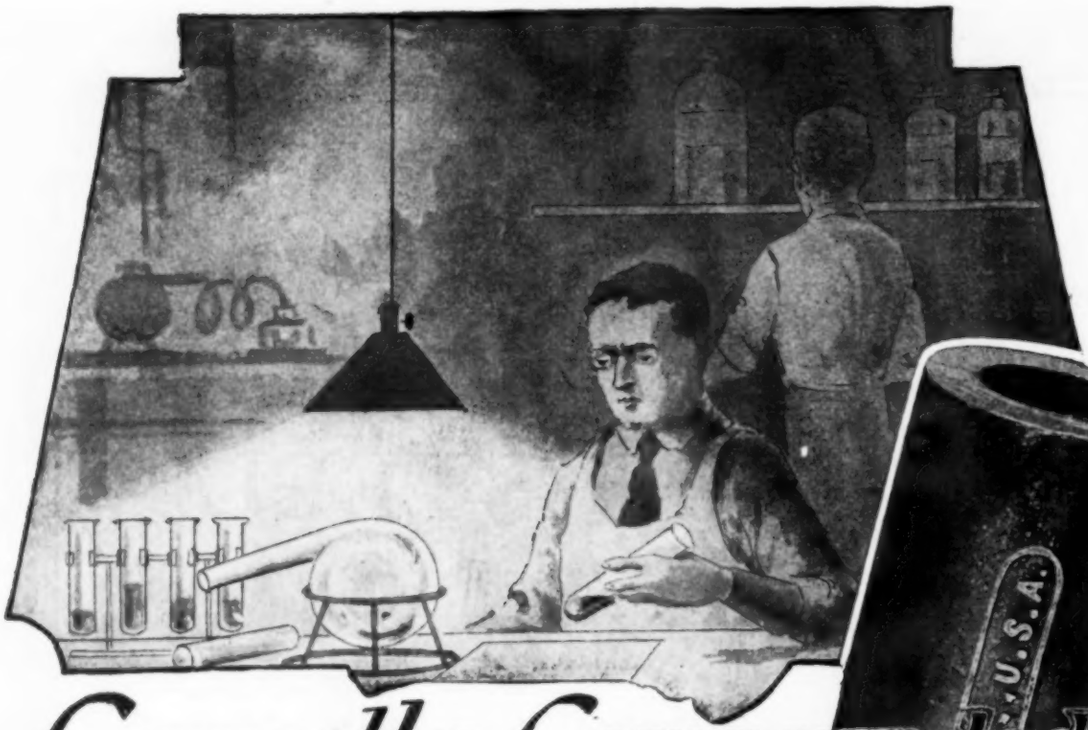

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STRENGTH AND ACCURACY COMBINED

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In the selection of the proper tool steel, have you considered the elimination of hardening losses, waste and time consumed in fitting and remaking warped or cracked tools?

The cutting power of Ketos Tool Steel has been proven over a period of fifteen years. Use it for dies, taps, broaches, master tools, test plugs, gauges. It won't shrink; it will cut better.

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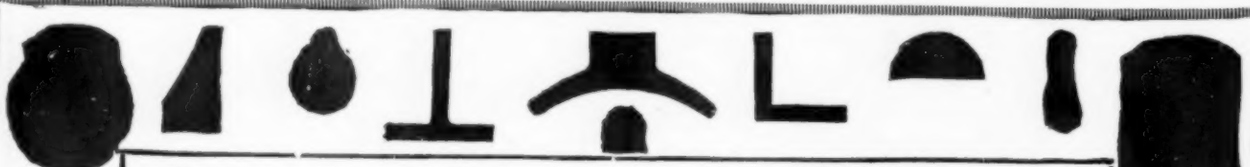

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THE LARGEST AND MOST COMPLETE STOCK OF COLD FINISHED STEELS

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COLD DRAWN SPECIAL SHAPES

Angles, Tees, Cutter Bars, Knife Backs, Bevel Edge and Cam Sections, Typewriter, Automobile and Special Machine Part Sections

We are prepared to furnish in the shortest possible time consistent with perfection in quality, a great many special shapes in accordance with specifications furnished. The accompanying illustrations will convey some idea of the irregular shapes we have made. The illustrations are intended only to show possibilities in the line of cold-drawn steel bar special shapes for manufacturing purposes.

Inquiries should be accompanied by drawing or sample section (the latter preferred), together with advices as to grade of material required, or the purpose for which it is to be used, and quantity involved.

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The Life and Prosperity of the Nation depend upon Adequate and Efficient TRANSPORTATION.
In building engines, cars and trucks; turning locomotive tires, car wheels; planing rails, frogs, switches; reaming, drilling, milling—in the many machine operations wherever increased production and long life of the tools is of vital importance
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Electric Welding

Thomson Butt Welders

More than half the time you spend forge welding can be saved by using Thomson Butt Welders. Large manufacturers the country over are using this standard equipment for welding pipe, iron and steel wire, automobile rims, etc. Increased output always follows a Thomson installation—and at less operating cost, too.

Bulletin BB

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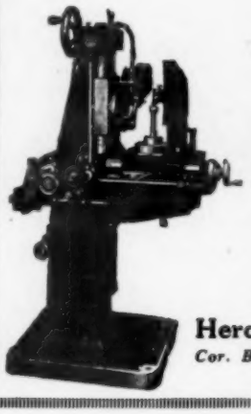

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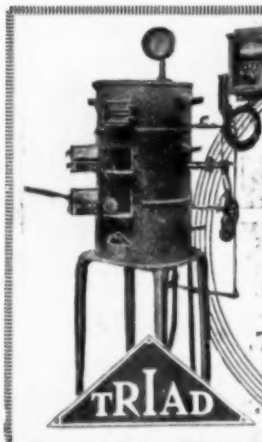

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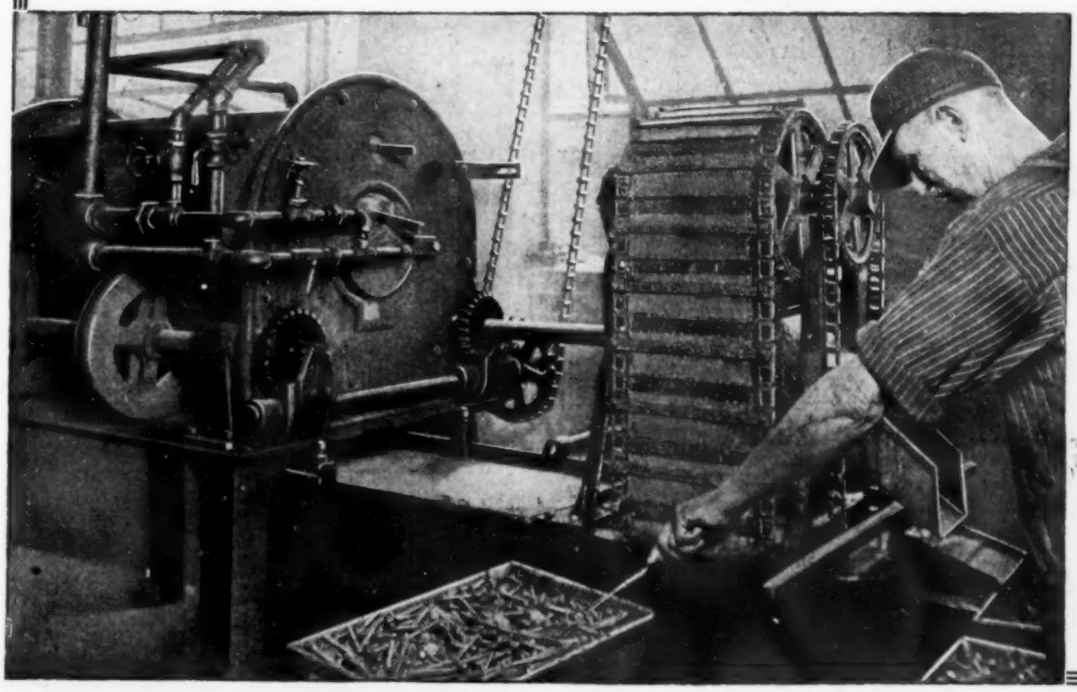

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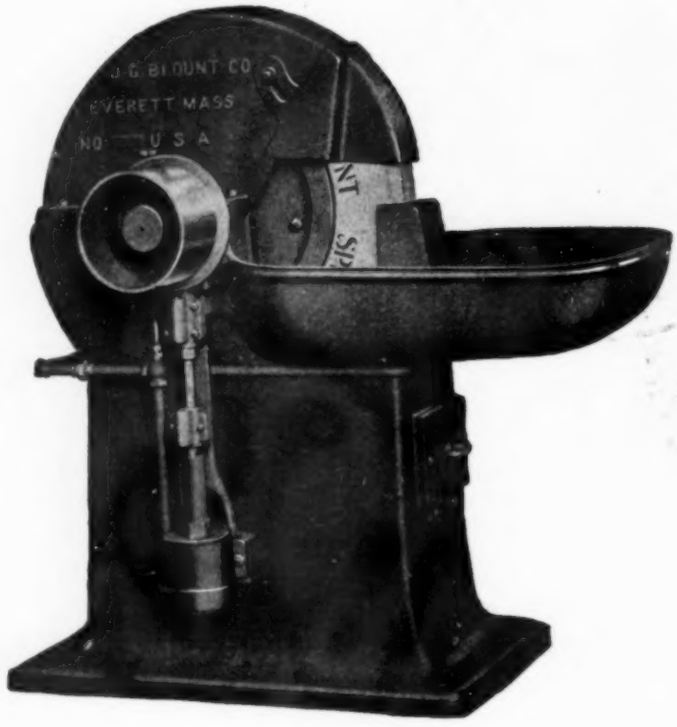

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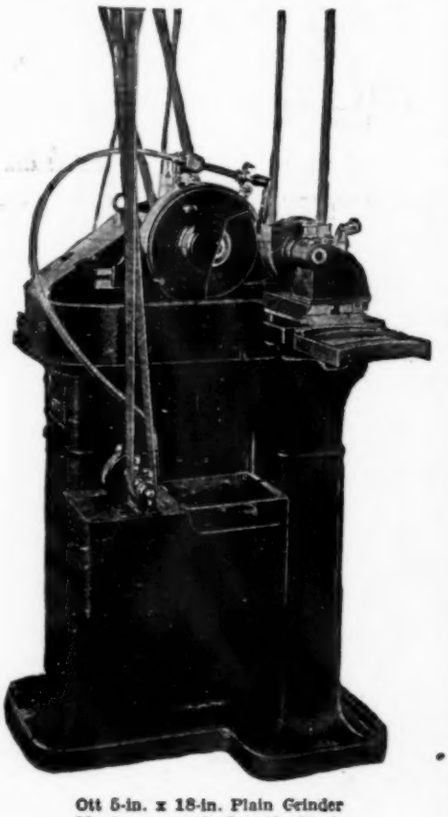

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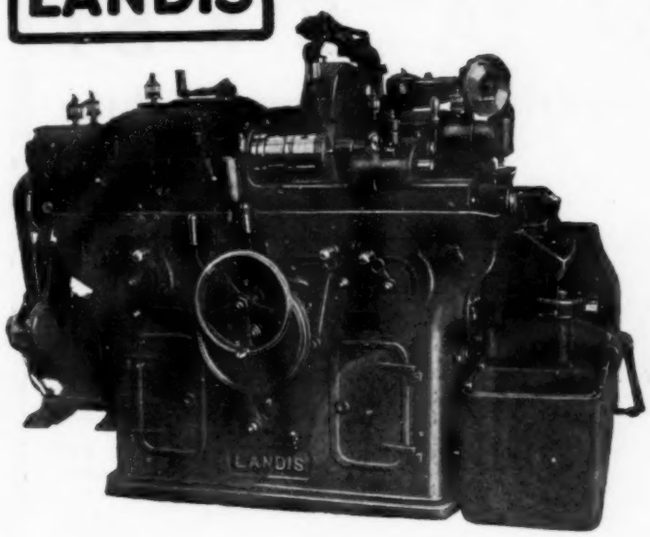

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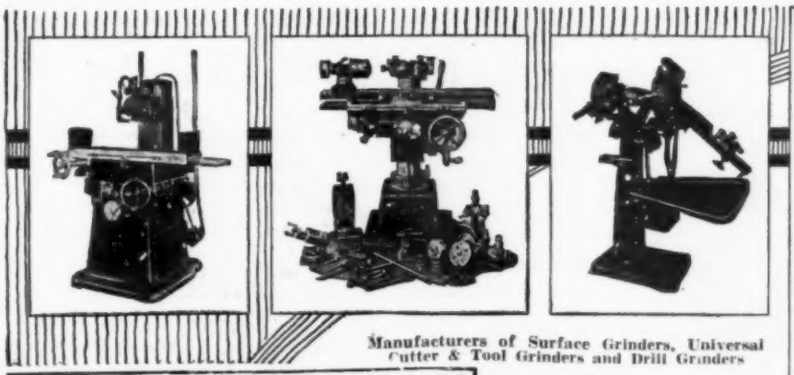

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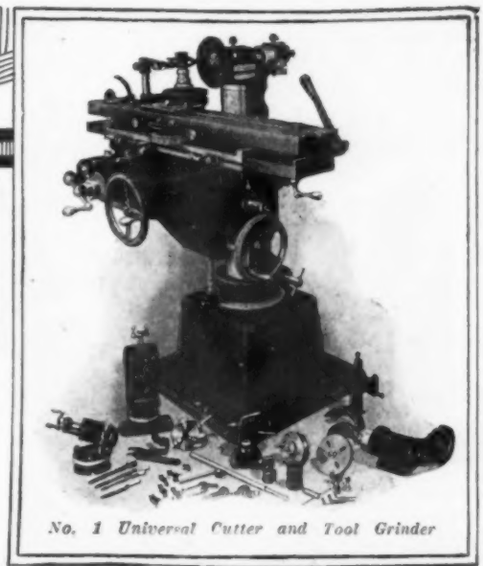

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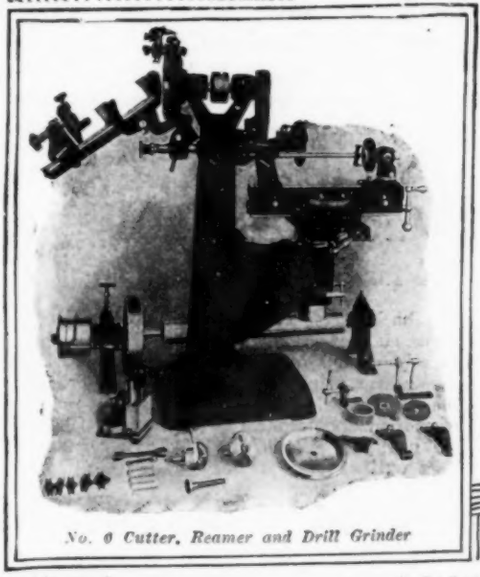

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3-in. dia. 7⅝-in. long
Grinding wheel spindle rear bearing
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16-in. dia. 1-in. to 3-in. face, 5-in. hole
Number of grinding wheel speeds (2)
1400 and 1640 r.p.m.
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Tight and loose pulleys on countershaft
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Centers swing 8 in. in dia.
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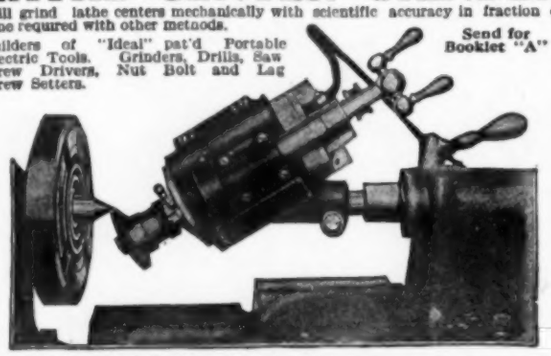

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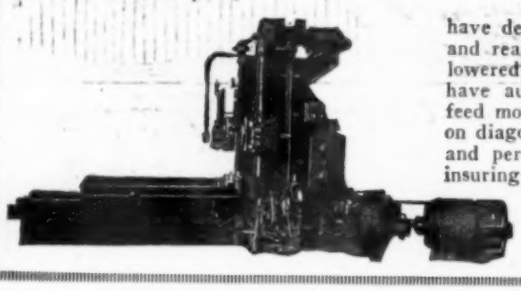
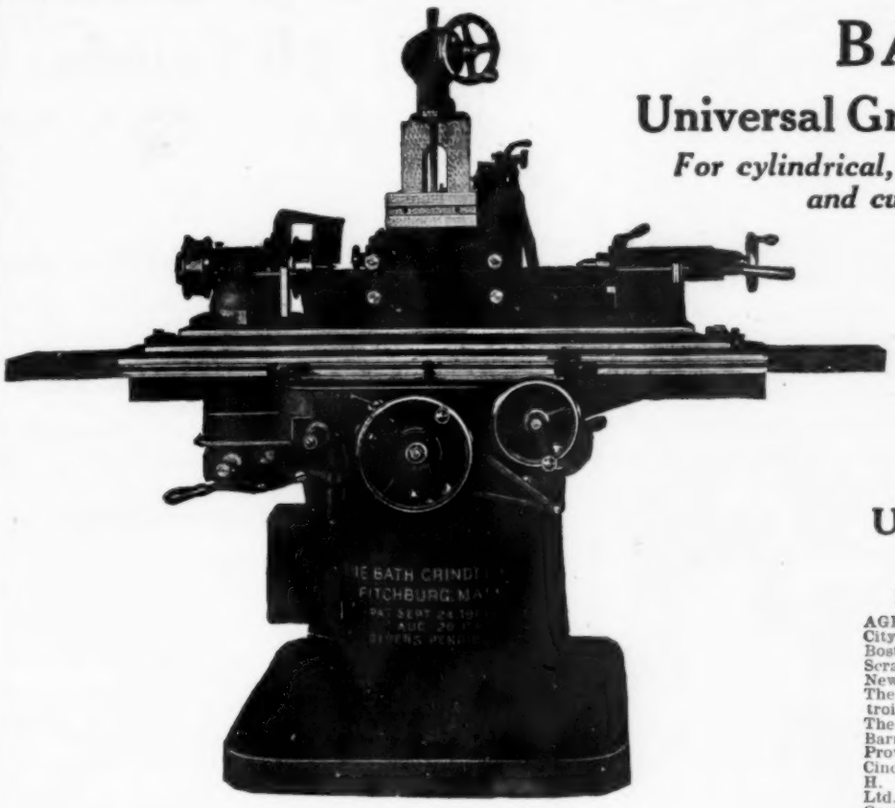


have deep box girder crossrail extending back between uprights and bolted front and rear, giving unusual strength to resist cutting strains. Crossrail raised and lowered by power and stops automatically at top of uprights. Heads on rail have automatic tool lifter. Side heads have spring relief tool apron. Patent feed motion. Independent feeds. Table driven by our well known spiral pinion on diagonal shaft, giving smoothness of motion unobtainable by any other method and permitting bracing of bed between uprights. Ways oiled by power pump, insuring thorough lubrication on short as well as long stroke.

Tool Grinders Shafting Drill Grinders



BATH

Universal Grinding Machine

For cylindrical, surface, internal, tool and cutter grinding

Made in 3 sizes

No. 1—10-in. Swing, 20 in. between centers, wheel 10 x ¾.

No. 2—10-in. swing, 25 in. between centers, wheel 12 x 1½.

No. 2½—10-in. swing, 36 in. between centers, wheel 12 x 1½.

Built by

Universal Grinding Machine Co.

Fitchburg, Mass., U. S. A.

AGENTS: The Fairbanks Co., New York City, Albany, Syracuse, Utica, Buffalo, Boston, Hartford, Newark, Philadelphia, Scranton, Baltimore, Birmingham, Ala., New Orleans, Chicago, Ill., and St. Louis. The Wolverine Mchy. and Supply Co., Detroit. The Hess-Schenck Co., Cleveland. The National Supply Co., Toledo, Laughlin Barney, Pittsburgh, Brownell Mchy. Co., Providence. Manning, Maxwell & Moore, Cincinnati, San Francisco and Seattle. W. H. Savage, Fitchburg. Alfred Herbert, Ltd., Great Britain, Japan, Australia. George E. Fogarty, Paris. Oscar Ericsson, Copenhagen. American Machinery Syndicate, Spain. R. S. Stokvis & Zonen, Holland.

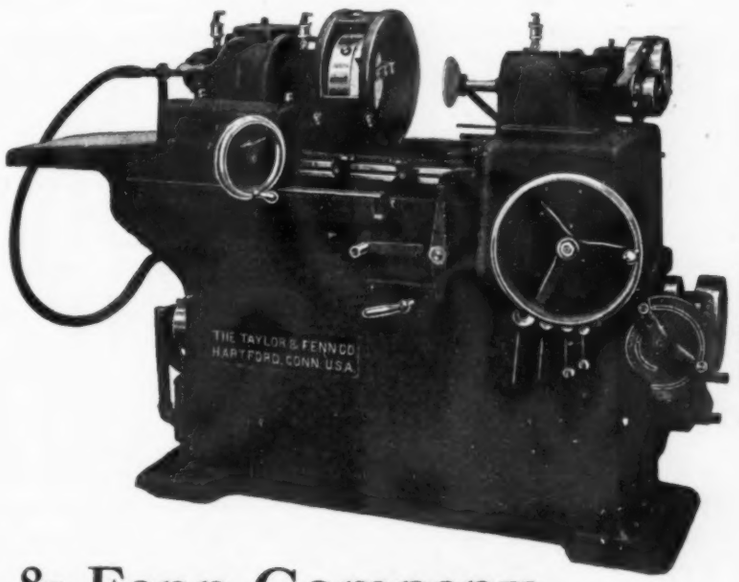
700 to 1500 lbs. heavier— vibration less in proportion

The Taylor & Fenn Straight Bore Grinding Machine is from 700 to 1500 lbs. heavier than other machines of like capacity. This extra weight is so located that it tends to steady the machine and it therefore grinds with practically no vibration at all. If your eyes were bound up and your hand were placed on the wheel head you would have a hard time to decide whether or not the machine was running.

The wheel head spindle is held vibrationless by 2525 lbs. of rigidity.

This unusual rigidity is a big feature but it is only one of many important advantages in design of the Taylor & Fenn Grinding Machines.

Get our catalog today. It gives all of the features of design of this machine that was built to do one thing better than any other machine of its kind—grind straight bores.



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Wet or Dry

Here is the modern tool room grinder, staunch enough for heavy cuts, precise enough for fine work, and built on the unit system, so that exhauster attachment for dry grinding or wet grinding attachment can be applied efficiently.

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East Providence, R. I., U. S. A.

It Grinds

thread gauges—internal and external, taps—straight and taper; dies, hobs, worms—reamers—taper, straight and rose; size gauges, step gauges, snap gauges, end mills—in fact anything that can be ground.

The Lafayette Universal Grinder

has a place in every shop. Its versatility makes it invaluable.

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Only carefully ground tools can produce high-grade work. For this reason alone you should exercise extreme care in the selection of a tool room grinder.

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Woods Toolroom Grinder

The Woods Engineering Co.
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When you need industrial diamonds get in touch with any of the branches or the main office—whichever is nearest you. We have spent twelve successful years putting the right diamonds onto the right job. We can guarantee you minimum cost per dressing.

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Multi-Graduated Precision Grinder

For Thread Grinding

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Grinding and Polishing Machinery

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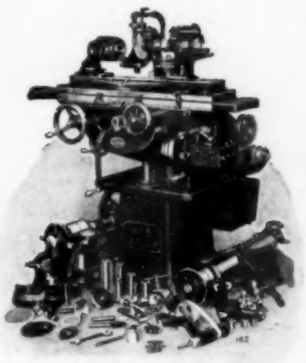

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—not only with the broom, but by proper storage of those materials which accumulate around the shop, and give it a lack-of-system look. Send for circular of Brown Sectional Stock Racks, it shows you how.

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your small metal parts at a positive saving by equipping your shop with an

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The recently designed Badger Grinder, incorporating many practical ideas which are the result of years of experience, places the disc grinder on the list of necessary machine tools.

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The BARNES Precision Cutter Grinder

is the fastest grinder for doing accurate sharpening of cutter without changing the relative diameters.

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Drill Grinders Tap Grinders

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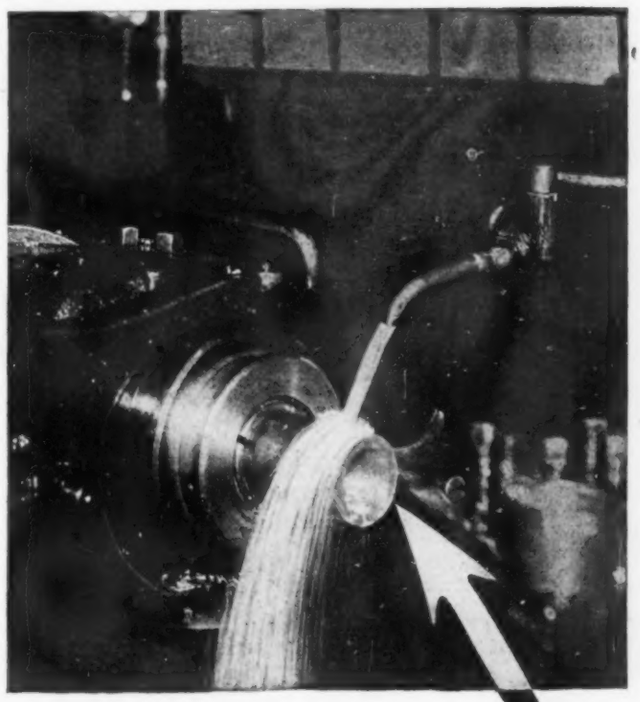

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How reliable is your defense against the danger of overheating, when metal is being torn away at a terrific rate? With everything at stake, don't you think it's good policy to install the trouble-proof pump of large capacity, whose response to the operator is instantaneous?

The famous non-stop Trahern meets the need of each moment—whether a trickle or a torrent up to 16½ gallons a minute.

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A Trahern is easily installed and when set up correctly never loses its prime. Reversible types reverse automatically with the machine, and operator can shut off flow at the discharge without stopping pump. Runs at low speed, hence upkeep is minimized and long life assured.

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Geo. D. Roper Corp.

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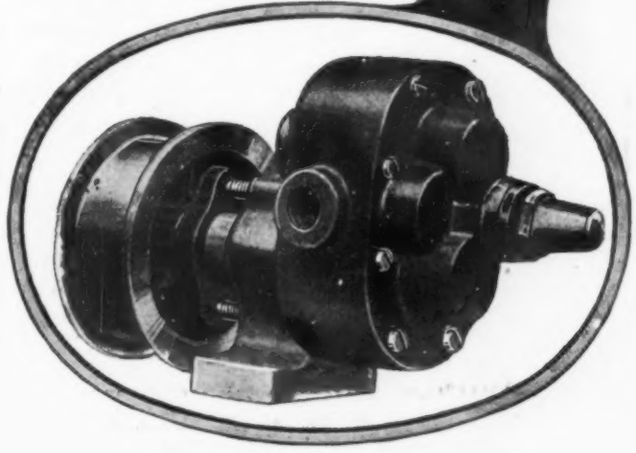

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SUPERIOR
WALTHAM, MASS. U.S.A.

SUPERIOR abrasives for fast, cool cutting are compounded by three processes to give Superior Corundum Wheels their widely known ability to tenaciously stand the strain of hogging off. There is no grinding machine that cannot be a more practical piece of equipment when coupled up with the right Superior Wheel. The right wheel can be determined by our engineering department.

Reduce Grinding Costs for 1921 with Vitrified Wheels

You can take off part of the costs charged to grinding, if you install the grinding wheel that cuts faster and wears more slowly. A "Vitrified" wheel, since it is welded at a terrific heat, is porous and cool cutting—never glazes—yet the bond is so hard that it actually helps the abrasive in cutting metal. There's no breakage, fewer dressings and less truing with a "Vitrified."

Faster grinding, better work, is baked into Vitrified. We have the exact grade and grain for your work. Write for it today.

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Grinders and Grinding Appliances

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There is a "Safety" for every grinding need, assuring maximum output and safety at minimum operating cost.

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Grinding Wheels

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If these interest you, you are also interested in our electric grinders and polishing machines.

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GRINDING WHEELS

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Place Your Grinding Department on a Paying Basis.

They insure Maximum Output

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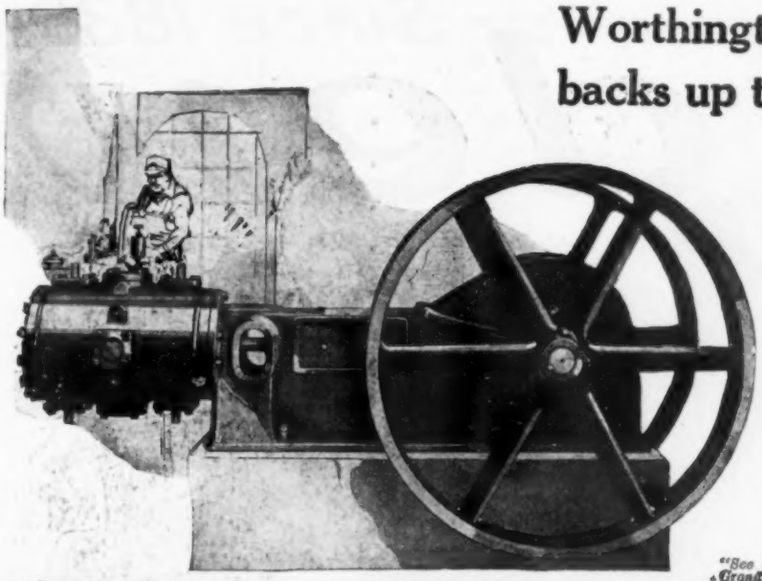

Worthington "FEATHER" Valve (REG. U. S. PAT. OFF.) backs up the production chief

. . . . because with "FEATHER" (REG. U. S. PAT. OFF.) Valve equipped Air Compressors at the pump end of the air line, there is never a failure in air service.

For Chipping operations, Chip blowing, Pneumatic hoist service and the like, there is no more certain performing apparatus than Worthington "FEATHER" (REG. U. S. PAT. OFF.) Valve Air Compressors.

Worthington Pump and Machinery Corporation
Executive Offices: 115 Broadway, New York City
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"See our exhibit at the Sixth National Exposition of Chemical Industries at Grand Central Palace, New York, Week of September 20th."

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A Single "ROSS" 2-Way Pump on Twenty-one Drill Presses in The Steel Products Company, Cleveland

Twenty-one high speed drill presses are supplied their cooling compound through a ½-in. pipe in a steady, pressureless stream from a single pump.

The Ross Pump works with the same outlet with either direction of pulley and can be connected up in any one of four different positions.

The gear ratio is four to one, giving a high impeller speed with a slow pulley speed.

The Ross Pump is light, neat, simple, and designed with a light vanadium spring steel open impeller, eliminating end thrust.

If you are having pump troubles or want better pump efficiency write for catalog today.

The Ross Manufacturing Co.
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Since 1835

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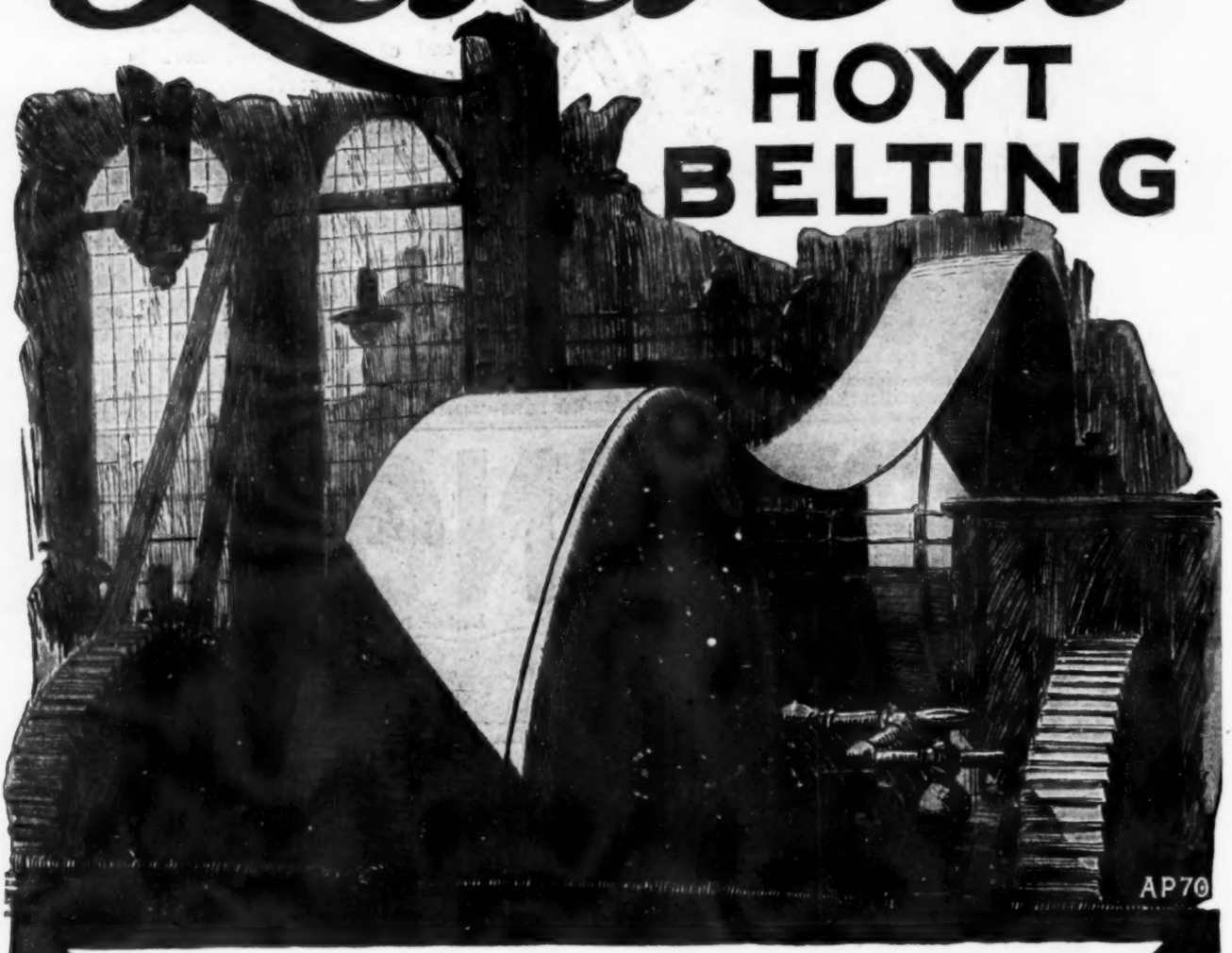
HOYT BELTING



BIG belting problems—such as require belts like these pictured here—are usually put up to Ladew because Ladew's facilities and experience are the biggest in the belting world. But—those facilities and that experience are just as valuable and just as applicable where the conditions call for the smallest belts. Big or little, there's only one Ladew belting standard. And—whether you need a big belt or a small one—Ladew engineers are at your service, ready to put 85 years of the "Know How" of belting on your particular, individual problems.

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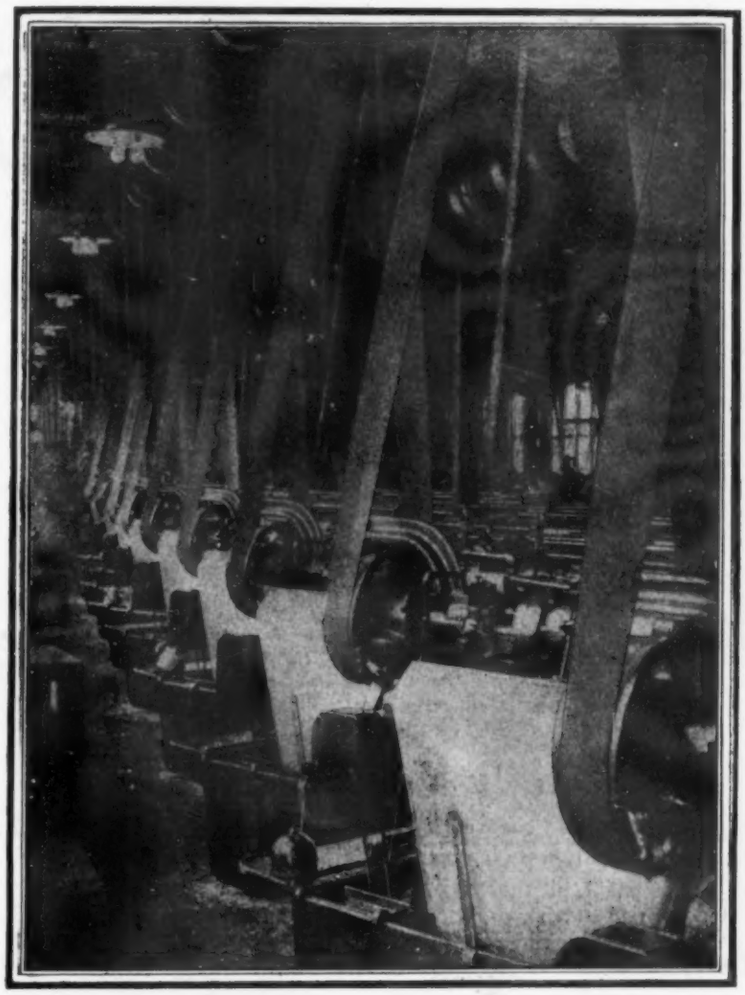
THE CORRECT BELT FOR THE MACHINE SHOP

An installation of automatic screw machines in a large machine shop—Equipped with G & K belts



This trademark is the symbol of the scientific control of tanning and manufacturing processes and the application of the correct belt for every drive in every industry.

"Aw, you can't scare me"

"BRING on your deep cuts, your oil and cutting fluids, shift me frequently, you can't scare me or stop me," says the sturdy G & K belt.

"I'll pull you machine right through peak loads without a bit of chatter or slowing up, whether it's an automatic screw machine, a grinder, planer, miller or what not. No difference to me! Just watch me turn out the work!

"You fellows who have had belts that slipped and slowed down the machine so that you had to back up and start over, or take a shallower bite—you are the boys who can appreciate me.

"I do the work right because I was built especially for the job by G & K engineers who knew what I'd run into after they had said good-bye to me.

"Those engineers have prepared a book, 101F, that specifies the correct belt for every drive in the machine shop and gives a lot of handy 'dope' on belting. Better write 'em for it—they'll be glad to send a copy free."

The Graton & Knight Mfg. Co.

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Distributors and Branches in All Principal Cities

14

Graton & Knight

Standardized Series

Leather Belting

Tanned by us for belting use

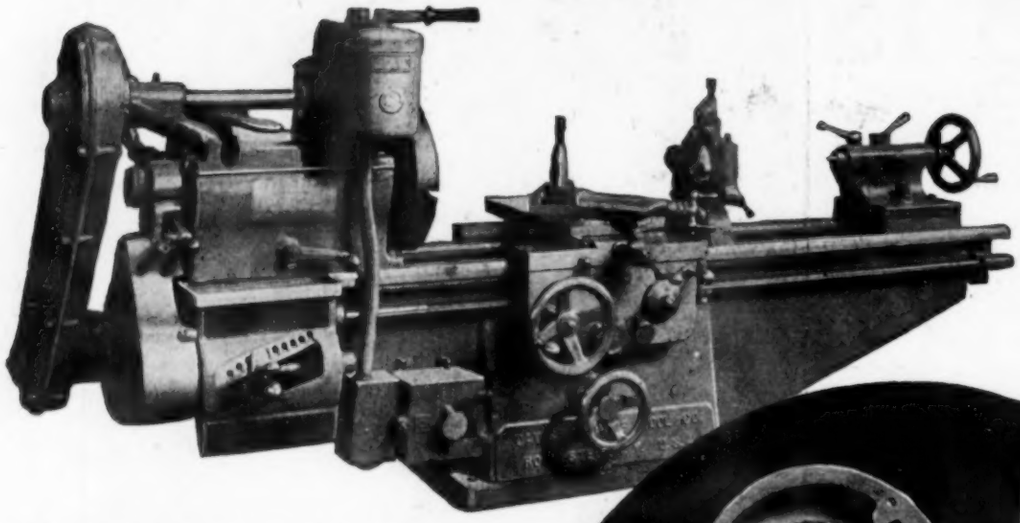
Liberty Lathes Are Regularly Equipped with

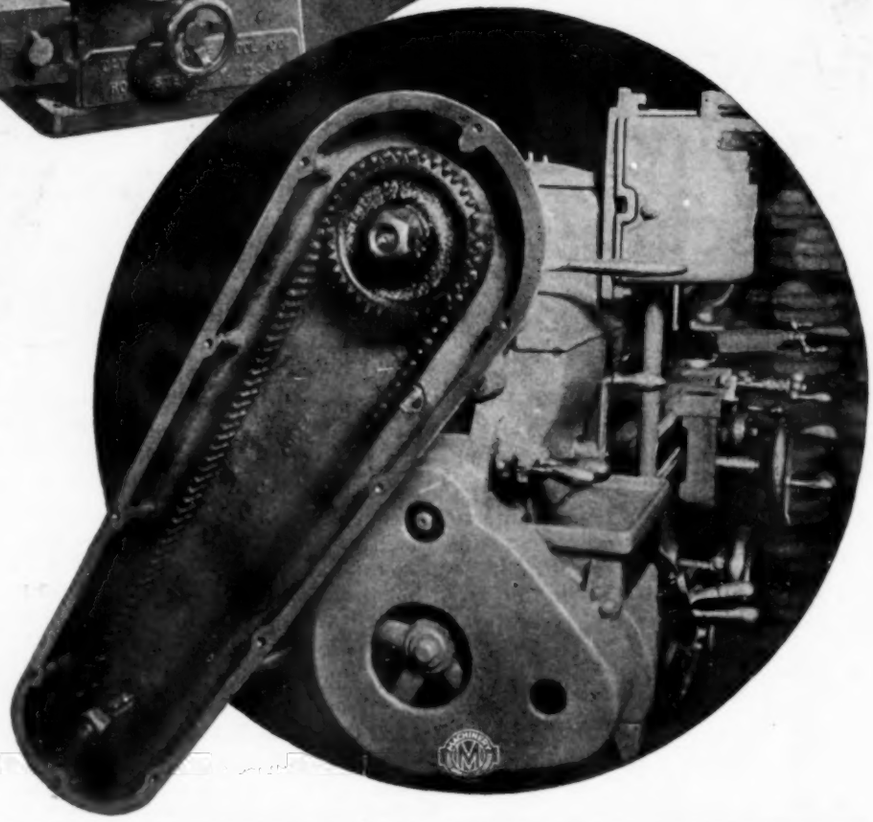
The Sign of Efficiency — *The Sign of Durability*

MORSE DRIVES

THE MORSE "ROCKER JOINT"

Positive as Gears — *Flexible as a Belt* — *Longer Life*





These photographs of Liberty Lathes were obtained at the Davis Machine Tool Works, Rochester, N. Y., where 1000 of these machines equipped with Morse Silent Chain were made for the U. S. Government.

The world's leading engineers agree as to the suitability of Morse Silent Chain to transmit power direct from motor to lathe head; it eliminates a long, noisy train of gears which wear rapidly and waste power. This particular chain is 1½ in. wide, ½ in. pitch (19 tooth pinion, 37 tooth spindle gear) and connects a 1¼ HP. motor to the geared head of the lathe. Distance between centers is 24 5/16 in.

The superiority of Morse Rocker Joint Chain in modern power transmission equipment lies in its smoothness, uniformity and durability, its economy of space, power and upkeep.

Let us tell you more about it

MORSE CHAIN CO., ITHACA, N. Y.

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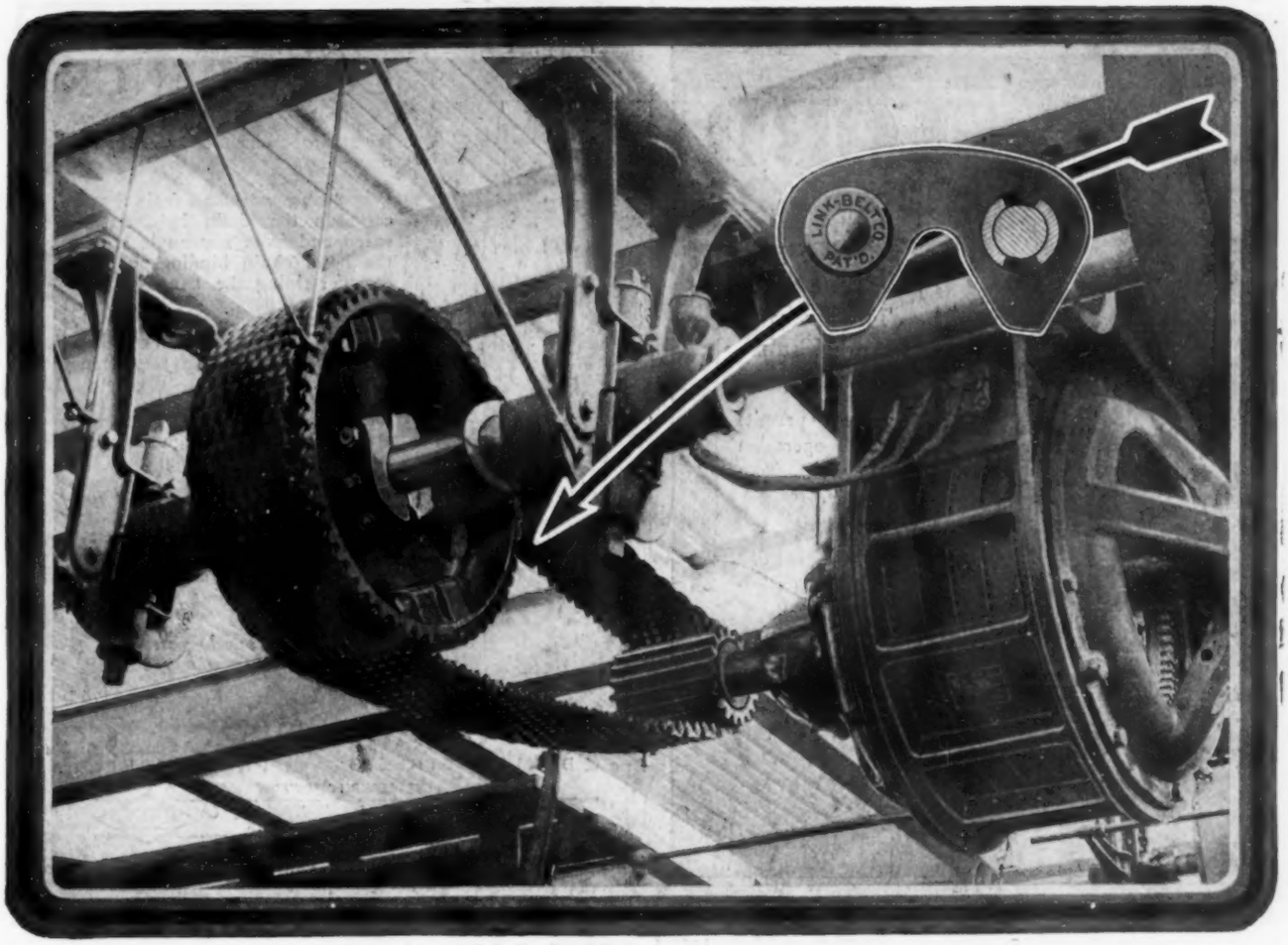

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THIS is the way to transmit power and it is being done every day in modern mills, factories and plants throughou the country by Link-Belt Silent Chain Drives.

Link-Belt Silent Chain Drives transmit all the power of the motor to the machine for useful work without the slippage and constant loss of power so common with leather belts, and without the noise of gearing.

Link-Belt Silent Chain is the ideal method of transmitting power. If you want 98.2% efficiency in power transmission, learn all about the Link-Belt Silent Chain Drive. Write for Data Book No. 125.

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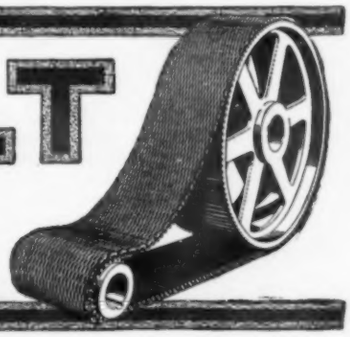
SILENT CHAIN
FOR POWER TRANSMISSION



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When your workman feels that he can run the chain hoist at any speed and from any angle without the hand chain binding, gagging, or over-riding the flange—

That workman is going to give more attention to the work in hand—the work *you* make *your* money out of.

The FORD TRIBLOC is made to stand up under rough service—and does.

Capacities: Half a ton to twenty—and more.

Catalog: Interesting—if you want economical lifting and carrying.

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2ND & DIAMOND STREETS PHILADELPHIA, PA.

OVER-SEAS REPRESENTATIVE
ALMACOA ALLIED MACHINERY COMPANY OF AMERICA ALMACOA
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One piece frame accurately jigged insures perfect alignment of shafts and rigidity of bearings.

Any standard hoist motor can be used. Hence standardization of motor equipment throughout your plant is possible.

Suspension yokes and trolleys are interchangeable and all fit our standard hoist casings.

All gearing fully enclosed in dirt and weatherproof housing.

All gears, including the load brake, run in oil.
Fewer parts and heavier—more rugged design.
Perfect accessibility of all parts.
Ample stock of spare parts always on hand.
Each hoist is fully guaranteed.
Let Euclid carry the weight of your lifting problems.

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Install the Modern Time-Saving

PEERLESS HOISTS

You avoid the inconvenience of delays. You insure accuracy where speed is vital.

They are especially designed for strength, protection against wear, and light weight.

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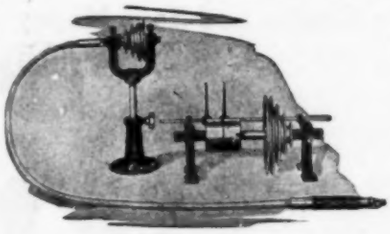

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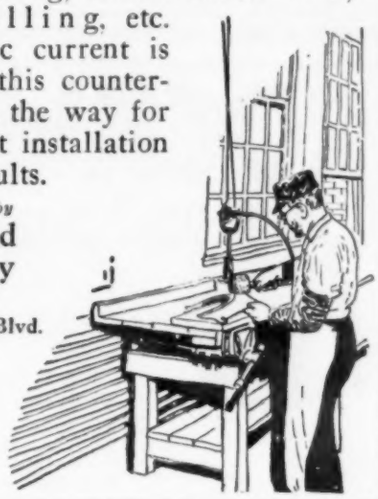
TYPE "C" Countershaft Equipment

Strand Type C countershaft equipments are made in several sizes.

A machine of unlimited usefulness for grinding, polishing, scratch brush work, scraping, drilling, etc. Where electric current is not available this countershaft provides the way for a flexible shaft installation with good results.



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Contains Complete Information regarding Friction Clutches for all Kinds of Work.

Weights, Bores, Dimensions, Speeds, Horsepower, etc.

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If you have any use at all for Friction Clutches, you cannot afford to be without our Catalog.

"M. & W." Friction Clutches Eliminate Transmission Troubles.

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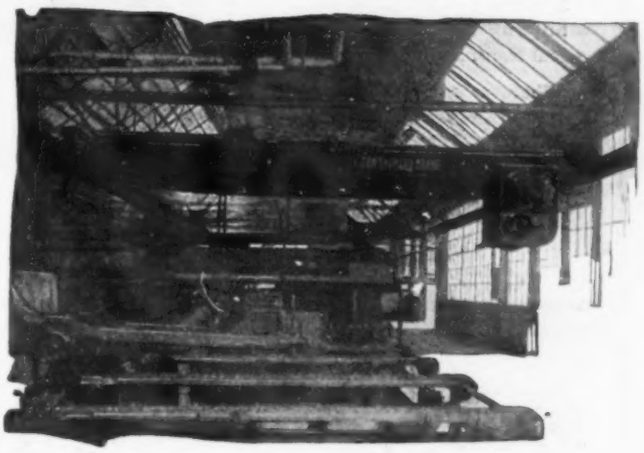
ELECTRIC CRANES & HOISTS



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Permanent, ever dependable lifting and transferring service follows the installation of Shepard Electric Cranes and Hoists.

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Why pay five or six men to lift your work around the shop when the Canton Portable Crane and Hoist and one man does it at a fraction of the old cost. Look into this matter now—hundreds in use—reducing handling cost in shops and plants. Catalogue E-26 explains all its advantages—send for it.

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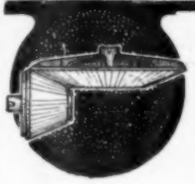

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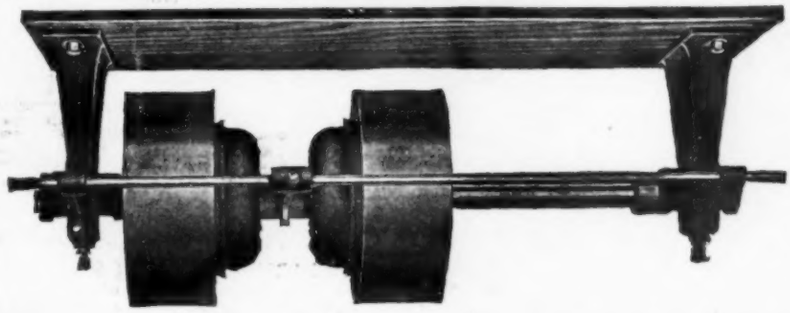

Practically 80% of the most prominent machine tool builders furnished "Edgemont" Countershafts with their products. They are self-oiling, and are smooth and easy running. Made with 8, 10 or 12-inch drop hangers with 4 ft. of shaft, shifter rod, fork and bracket.

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Operation of grinding or polishing machines demands high standards of belt service. And, wherever Gilmer Endless Grinder Belts have been installed, new records of service invariably have been established.

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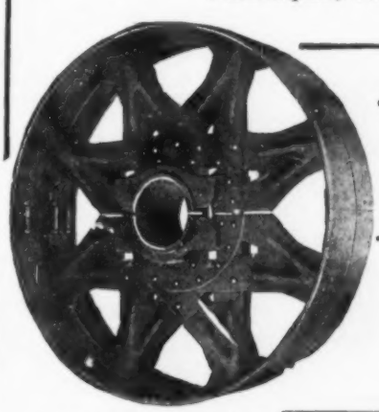

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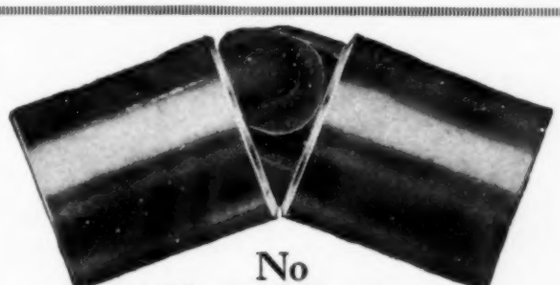

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The Gray & Prior Universal Joint is mechanically perfect in load transmission. Friction and wear are minimized by eliminating screws and small parts and by rounding contact edges. Circular upon request.

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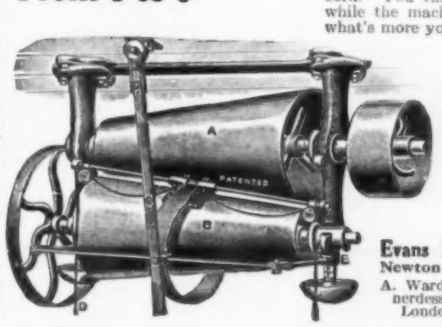


Catalog 252

Evans Friction Cone Co.
Newton Highlands, Mass.
A. Warden & Co., 48 Shepherdess Walk, City Road, London, E. C., England

During 1921
do your broaching the fastest way

IT'S the middle step in the path from specifications to finished work that counts most in broaching. The actual cutting is where time is gained or lost, where profits are earned and economy established.

It is the middle step, the actual cutting operation that is best taken care of on a **"Lapointe of *Hudson*"** Broaching Machine. This for two reasons: speed and quality. The **"Lapointe of *Hudson*"** Broaching Machine is the fastest on the market.

Since we are the originators of commercial broaching we hold certain fundamental patent rights which give our machines the most speed in "pull" and "return." The time between cuts on a **"Lapointe of *Hudson*"** is less than on any other broacher made.

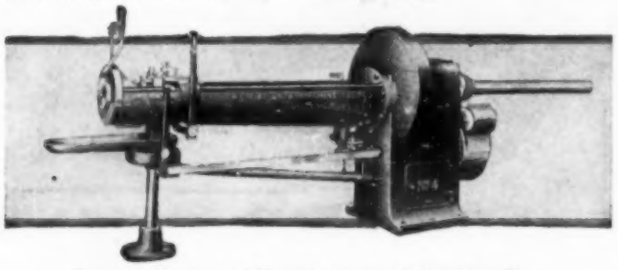
And in the matter of quality **"Lapointe of *Hudson*"** is second to none. These broaching machines are built in the belief that the highest possible quality is the least expensive in the long run. . Every part is a quality part.

For example, the draw screw, driving shafts, etc., are of the best grade of nickel steel, the drawnut of the best grade of phosphor bronze, and the gears, broaches, etc., of special steel treated in our own heat treating department.

Every part is thoroughly tested before being assembled, with the result that **"Lapointe of *Hudson*"** stands for a truly quality broaching machine.

If you have keyways, splines, oil grooves, gear teeth, squares, rounds, irregular or odd shapes, either straight or tapered or spiral to cut, you can accomplish it to the best advantage by adopting **"Lapointe of *Hudson*"** machines and broaches.

Our engineers are always glad to receive your specifications. They will give you definite data about the production on your work with **"Lapointe of *Hudson*"** *Broaching Machines together with costs, etc. Write for our catalog today.*



Lapointe Machine Tool Co.
Hudson, Mass., U. S. A.

Originators of Commercial Broaching

Remember! It's Lapointe of *Hudson*

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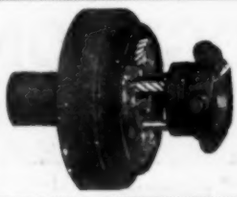

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Quick shipments from large finished stock.

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Made of LAMINUM. All features of solid shims, plus advantages of loose-leaf shims. They allow quick, accurate adjustment, and give a clear, smooth surface always. Send for sample.

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Any Horsepower
Shafts Either In Line Or At Angle

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Birdsboro Steel Foundry & Machine Co., Birdsboro, Penn.

For transmission drives for machinery—motor trucks—motor cycles—tractors. Sprockets of all kinds in any quantity. Send for Catalog Ed. F.

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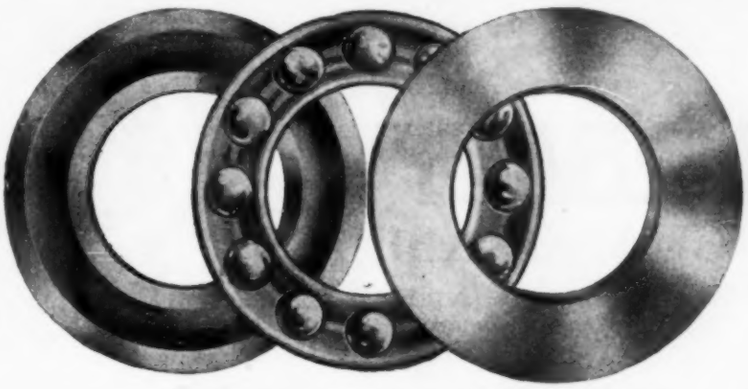
CRANES OF ALL TYPES



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Thrust Ball Bearings manufactured to your requirements.

"Star" Ball Retainers for Thrust, Magneto and Cup and Cone Bearings.

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One Bearing—
Or One Thousand

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BALL BEARINGS

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YOU PAY FOR THEM WHETHER YOU BUY THEM OR NOT

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THE

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ANNULAR BALL BEARING

Commercial Annular Ball Bearings are perfect for many purposes. There is no anti-friction bearing more successful in its own field.

Inexpensive. For moderate loads and speeds under 3,000 R.P.M.

Send for prices, samples and informative catalog.

The Schatz Manufacturing Co.

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WORM DRIVES Operate Better with AUBURN THRUSTS

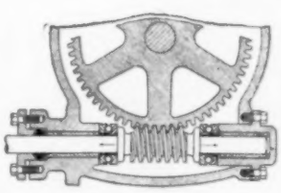
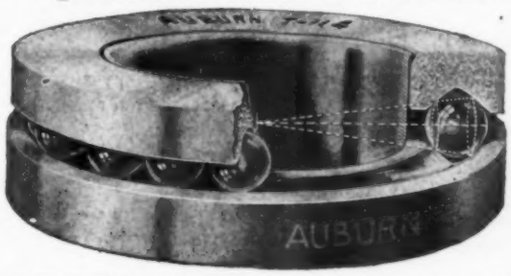


Fig. 1.



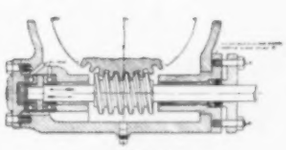


Fig. 4.

Worm Drives when equipped with AUBURN BALL BEARINGS are free from overheated bearings lost motion, and consume less oil, besides lasting longer, due to maintained alignment.

Send details of your problem and obtain the benefit of our 25 years' experience. Catalogue on request.

Steel, Brass and Bronze Balls

AUBURN BALL BEARING CO., 25 Elizabeth St., Rochester, N. Y.

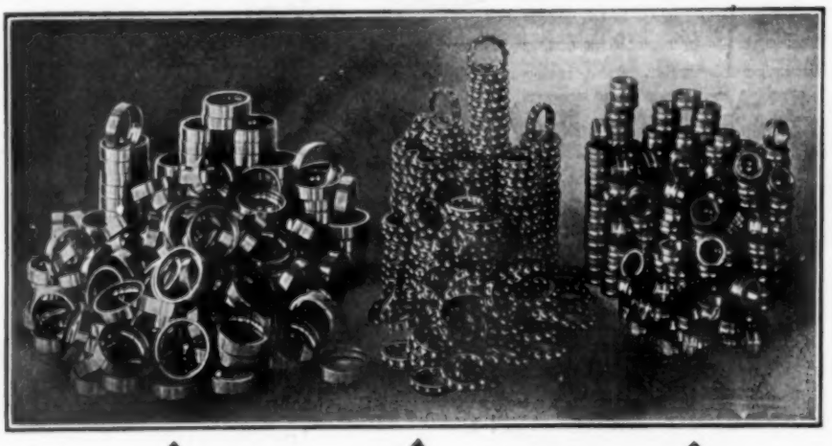
SILENCE

SPEED

"NORMA"

INTERCHANGEABILITY

Here is a pile of "NORMA" outer races—a pile of "NORMA" cages with balls—and a pile of "NORMA" inner races.



You may select any outer race from this pile.

And any cage with balls from this pile.

And any inner race from this pile.

Put them together—and you have a perfect "NORMA" Precision Ball Bearing—accurate as to size and dimensions and alignment — perfect as to true and silent running — as "frictionless" as a ball bearing can be made.

This is "NORMA" interchangeability—and we believe there is nothing to equal it, in the world of ball bearings.

Do you know of any other ball bearing that can be assembled from stock this way — and still be a perfect bearing?

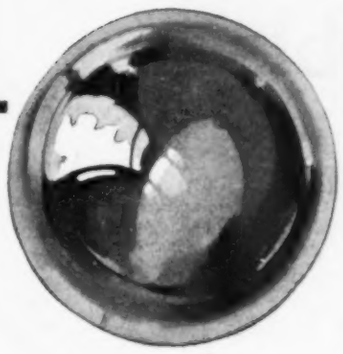
Think what this means, in facilitating that progressive assembling which reduces costs and increases production.

PRECISION

SERVICE

The Norma Company of America
Anable Avenue, Long Island City, N. Y.

HOOVER STEEL BALLS



BOTH speed and safety can be enjoyed when Hoover balls are used to liven bearing surfaces.

Their highly polished flawless finish and their absolute sphericity permit the highest speed because they prevent the theft of precious power by friction.

The use of bearings built on Hoover balls lets speed be made with safety, too. For such unusual care controls their manufacture that Hoover balls display a uniform load capacity surpassed by no other ball of equal dimensions.

HOOVER STEEL BALL CO.
ANN ARBOR, MICH.

Branch Offices:
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Southern Representatives:
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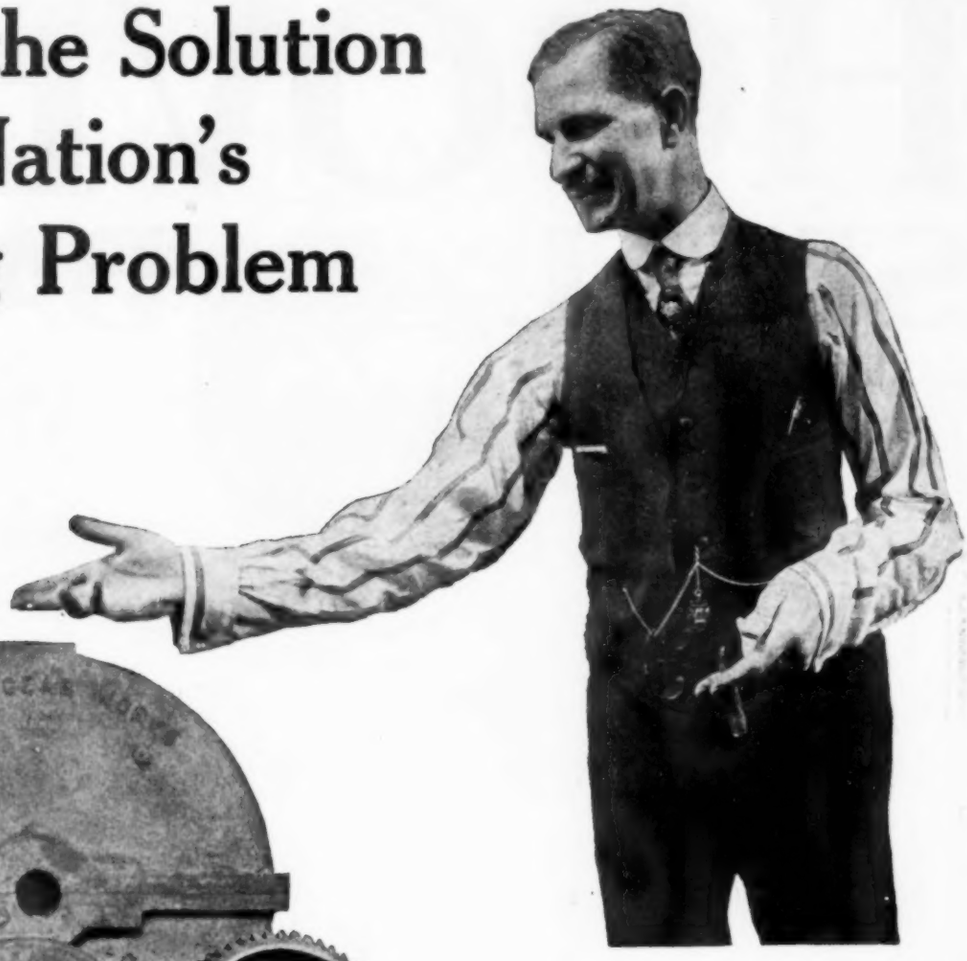
Spiral nickel chromium retort of *rotary furnace* which, revolving at a predetermined speed, discharges the balls heated to the proper temperature. Both feeding and discharging operations are automatic and continuous The entire heat treating operation is electrically controlled.

(4)

Here's the Solution to the Nation's Housing Problem



The Phillie Gear Book is a real first aid to gear ordering. It enables you to plainly state your gear needs. Order your copy before it slips your mind.

Some of you manufacturers pay too little attention to your speed reducing equipment. You seem to think that any old housing that reduces to the revolutions required is sufficient. You pay slight attention to the great power losses you suffer by carelessly choosing reducing units.

Philadelphia reducing gears and housings are mechanically correct. Their worms and worm wheels are of the usual high standard and they are cut to the close limits that transmit full horse power with minimum friction losses. Try one on your next reducing problem—you'll readily see what real quality means.

Spur — Bevel — Mitre — Spiral — Worm — Helical

Philadelphia GEAR Works, Phila. Pa.

Sprockets — Racks — Rawhide — Micarta — Gears

To the man who buys Lubricating Oil:

Suppose a salesman were to walk into your place today and say—"See here, I have a lot of different sized packing I can give you at 'half-price.' "

You would flash right back at him—"I want to know if they will fit my conditions."

If they didn't you wouldn't buy them at any price.

Now, it is much the same with oils.

You have to say to the oil company—"Will your oils meet my conditions?"

Texaco Lubricants WILL.

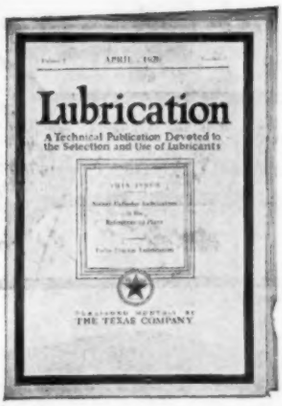
Beyond a doubt, we are meeting conditions identical with yours in a number of plants right now in various parts of the country.

With our technical representatives in the field keeping in touch with mechanical developments of all industries, touch with the mechanical developments of all industries, we have been able to contribute much to the science of exact lubrication.

That experience, with our facilities for utilizing it, have placed Texaco Oils and Greases beyond competition in quality.

Texaco Quality proves itself in the way in which Texaco Lubricants will operate to conserve power and reduce oil costs in your plant.

There is a Texaco Lubricant for Every Purpose.



In this magazine we print month after month, articles covering the problems of lubrication as applied to various industries.

These articles are not theoretical, but based on practical operating experience.

We shall send "Lubrication" to Engineers, Executives, Buyers of Lubricants, and others, who are professionally interested and who ask for it—FREE—for the time being.

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12-30

Cincinnati Gears

Are Made In a Daylight Plant

This means more to you than you suspect. It means ideal working conditions, and it guarantees our customers against small defects and inaccuracies which are liable to occur where men are forced to use artificial light most of the time.

Our plant is considered one of the most modern of its kind in the country.

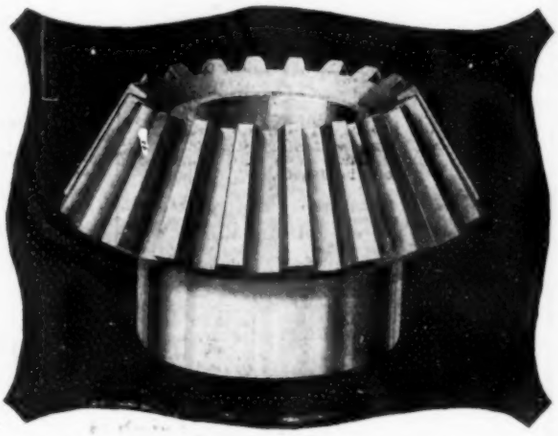
When you bear in mind that on top of this we have had 25 years' experience manufacturing gears, you can understand perfectly why Cincinnati Gears are famous for excellent service.

Let us tell you more about Cincinnati Gears and Cincinnati Service—a postcard will do.

The Cincinnati Gear Co.
1825-27-29-31-33 Reading Road, Cincinnati, Ohio

CROFOOT GEARS

"The Standard for Quality"



The smoothness of operation of Crofoot Gears in drives where quiet, efficient action is an absolute necessity has made Crofoot Gears a standard for superfine production.

Made in small and medium sizes (1 in. to 12 in. diameter) in merdium and large quantities only.

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Boston 37, Hyde Park Avenue at Readville, Mass.

Trade Mark

Jones Gears

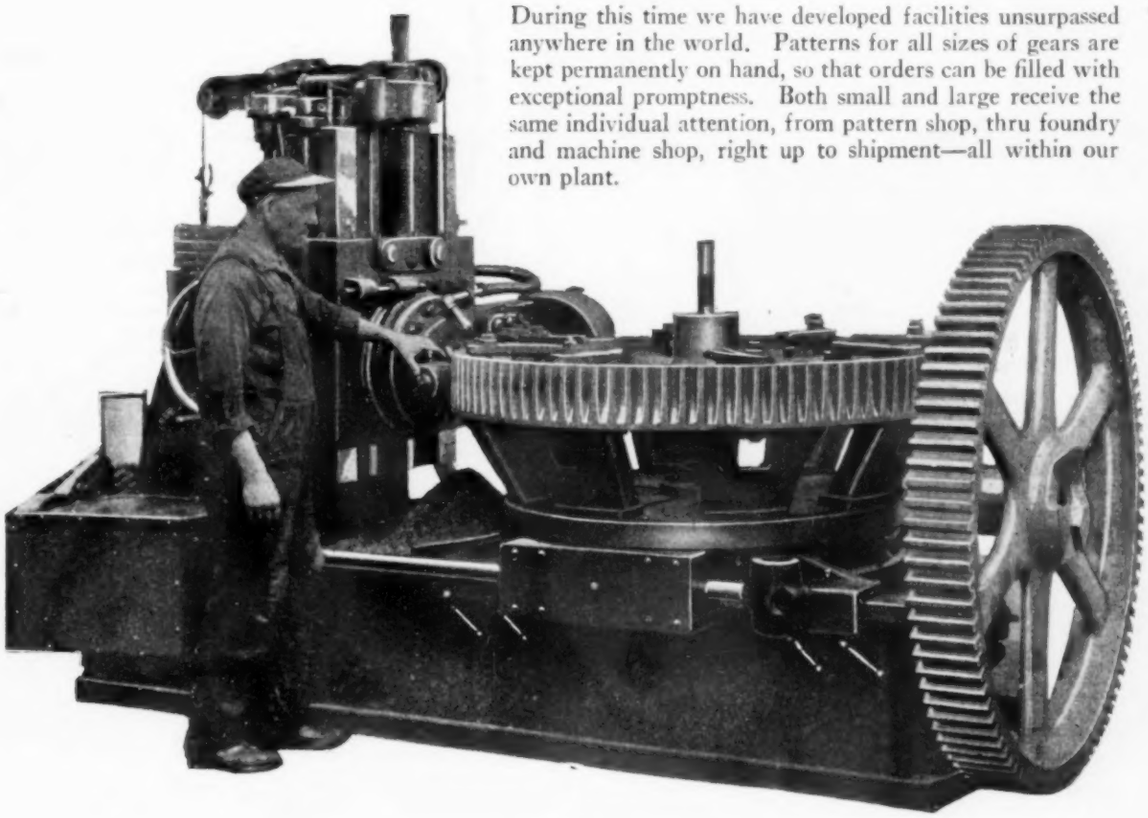
and the Service that goes with them

Cast Iron
Steel
Bronze
Rawhide
Bakelite Micarta

EVERY Gear order filled at the Jones plant is handled with special regard to the particular purpose for which the product is intended.

It is not merely a matter of following specifications. We make it our business to see things *from the customer's viewpoint*—that is why many of the largest manufacturing concerns in America have been ordering from us for the past thirty years.

During this time we have developed facilities unsurpassed anywhere in the world. Patterns for all sizes of gears are kept permanently on hand, so that orders can be filled with exceptional promptness. Both small and large receive the same individual attention, from pattern shop, thru foundry and machine shop, right up to shipment—all within our own plant.



W. A. Jones Foundry & Machine Co.
4404 West Roosevelt Road, *Chicago.*
New York 20 Murray St.

Manufacturers of Cast Iron Pulleys, Gears of all kinds, Couplings, Lemley Friction Clutches, Pillow Blocks, Hangers, Speed Reducers and General Power Transmission Machinery

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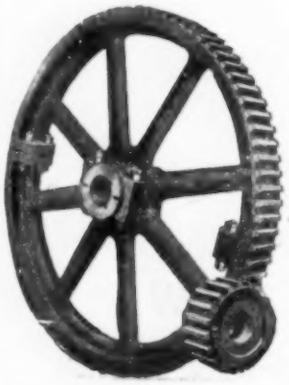

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Made of cast-iron, semi-steel, brass and bronze. Machine molded gears have true rims, accurately pitched and uniform teeth, backed by well proportioned arms and hubs, work smoothly and without vibration, save power and stand the best of continued severe service. We are equipped to furnish gears with machine cut teeth.

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Careful selection of materials, accurate workmanship and rigid inspection assure satisfaction when you use Foote Dependable Gears.
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Foote Bros. Gear & Machine Co.
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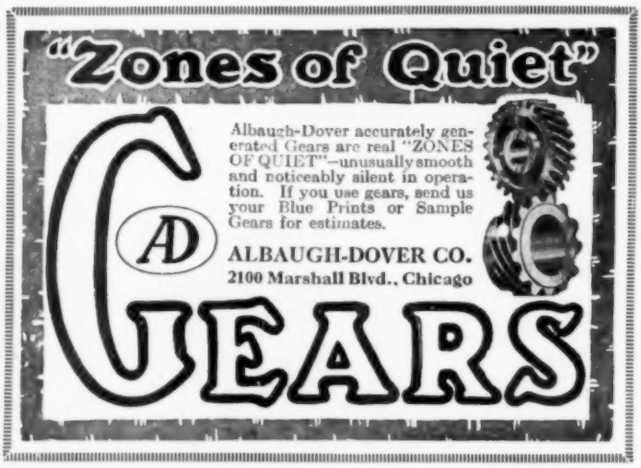
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Albaugh-Dover accurately generated Gears are real "ZONES OF QUIET"—unusually smooth and noticeably silent in operation. If you use gears, send us your Blue Prints or Sample Gears for estimates.
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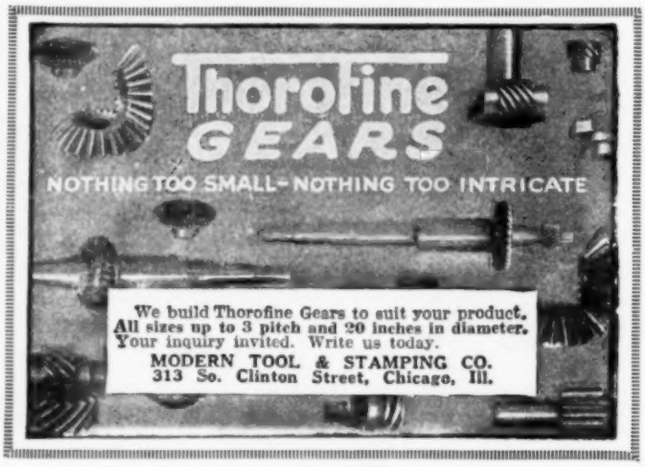
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Adaptable to any class of machinery where a positive silent drive is essential.

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No matter how big the gears you want may be, we can make them for you. We are specialists in the cutting of large worms, odd size gears of every kind and special shapes. We take care of the smallest sizes too, and o ur service booth is exceptional. Write for quotations and be convinced.

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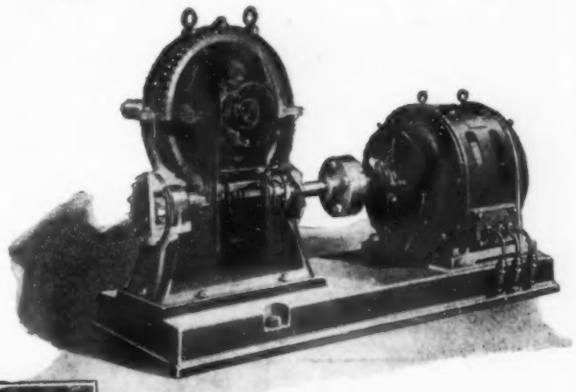

With High Speed Industrial Motors

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So unusual is its performance, so even its torque at all speeds, so silent and efficient its operation, that it opens up new possibilities in the use of high-speed motors.

The cost is reasonable. The results can be easily verified. Leading manufacturers in almost every line can testify. Thus an invitation to investigate and learn what we can do for you is really and sincerely an invitation to higher efficiency and permanent economy. We invite you to correspond with us.

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America's Worm Gear Specialists

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accurately cut in cast iron, steel, brass, rawhide and fibre.

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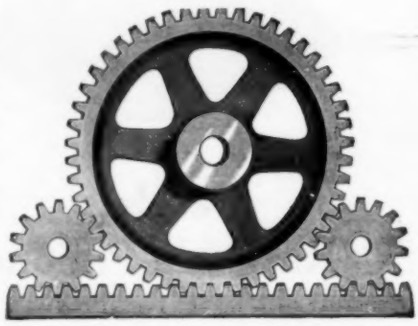

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Let us quote you on your small gears.

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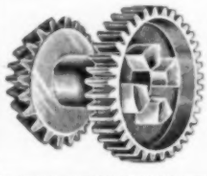

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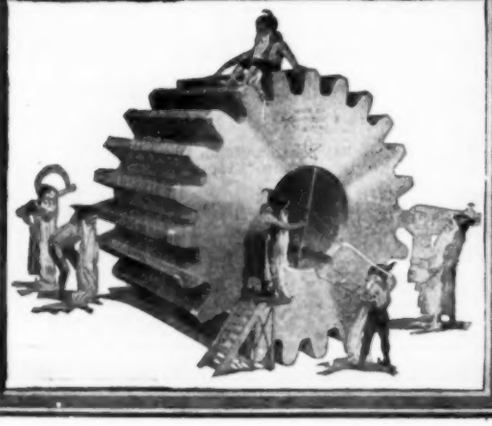

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and as promptly as you need them

Let us show you how quickly, how well, and at what reasonable cost we can meet your gear needs. You can depend on the same prompt courteous service whether for one gear or a thousand, spur, bevel, spiral or special gears, in iron, steel, bronze or *new process* Rawhide.

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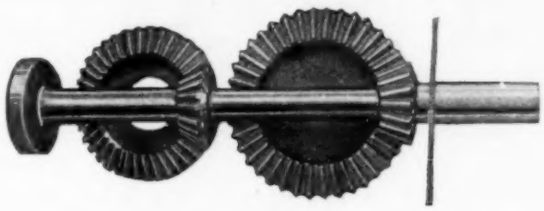

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Hard Jobs Are "Every-day" Jobs With Us

Bevel gears like those shown above are difficult jobs, when cut properly, but our reputation has been made by our ability to handle hard tasks to the super-satisfaction of our customers.

We are equipped so thoroughly with the latest machinery, that our gear experts consider the unusual job simply an every-day occurrence—and we often take on jobs successfully after the other fellow has given up in despair.

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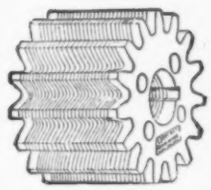
Rawhide Gears and Blanks



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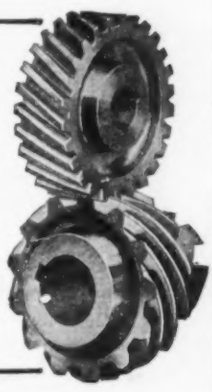
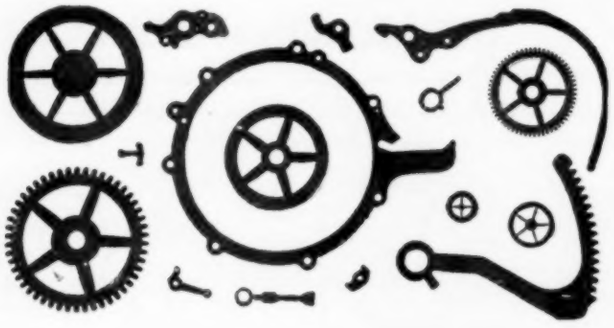


Distorted Work Avoided When You Use Waltham Sub Presses and Compound Dies

Punchings made by simple or tandem dies are usually more or less distorted and often have to be flattened by a follow-up operation. The position of the holes in relation to the outside of the blanks is also liable to vary considerably. High class work demands that these defects be overcome.



Waltham Sub Presses and Compound Dies overcome these defects. The piercing punches and the die for the contour are placed together in the same relation as in the finished punching. Opposite to them is the punch for the contour which also contains openings for the piercing punches and so becomes a die as well.

Waltham Dies are correctly made to maintain their size under successive sharpenings, because, as the blanks do not pass through the dies, the clearance angle can be very slight. Thus otherwise expensive parts, such as clock wheels and frames and meter frames, can be produced accurately and economically.

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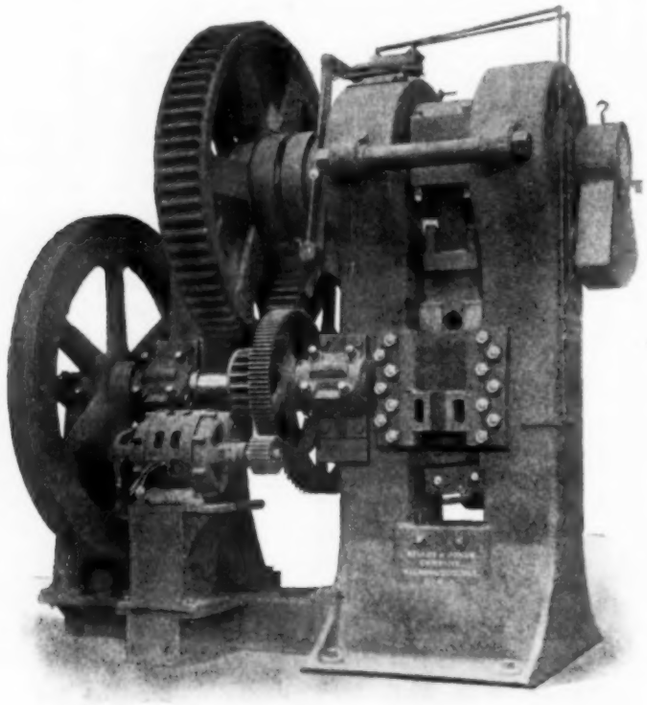

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This all steel geared Guillotine Shear cuts tough stock with slight effort. It has the capacity of 6-in. square bars, .60 carbon steel. The clutch is controlled by air cylinder and it has an 8-in. stroke.

Hilles & Jones Guillotine Shears are designed and constructed to stand the shocks and rough hard work of forge service. They are in demand for their ability to do so.

We build a full range of sizes to handle every style of work.

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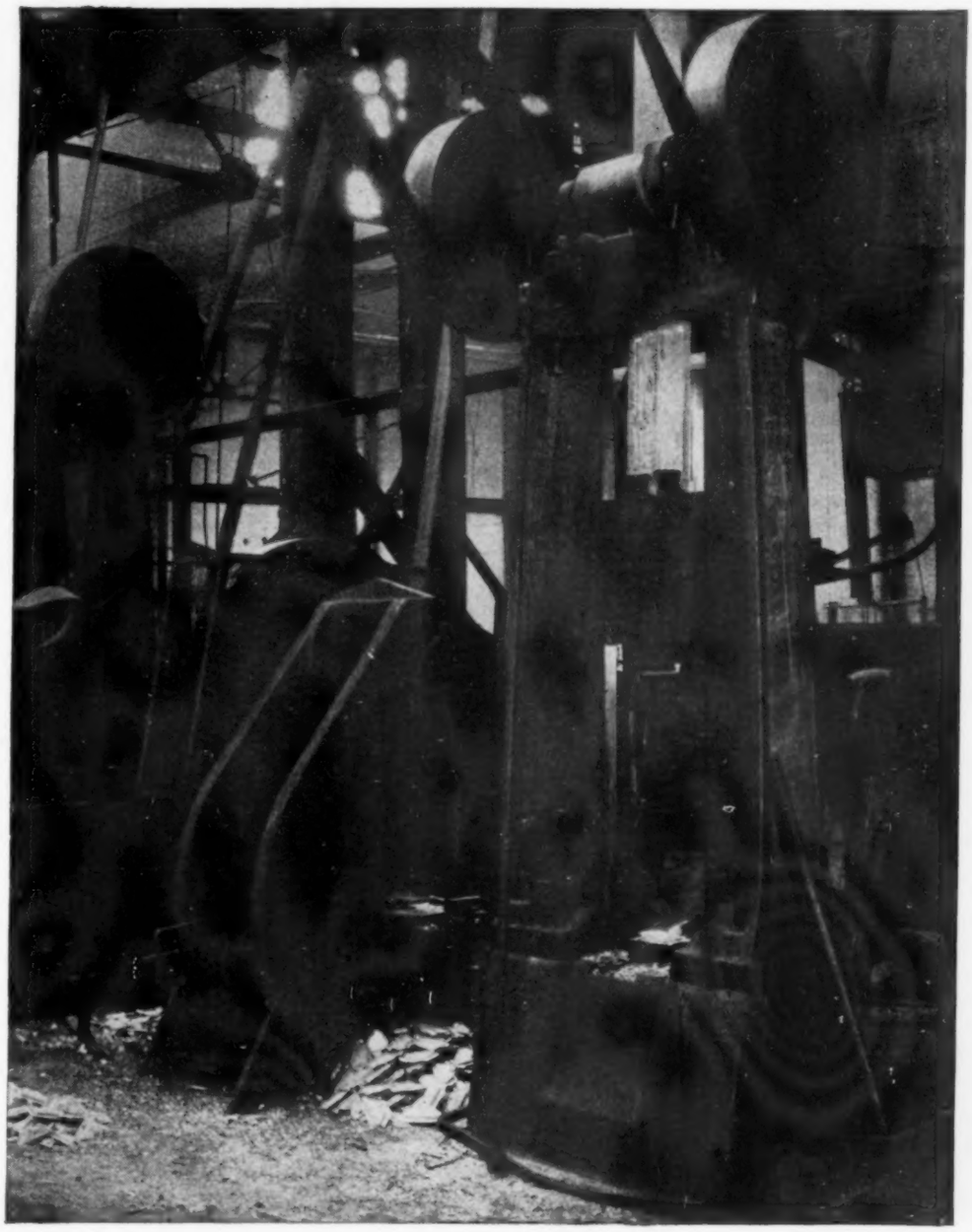
One of the Hilles & Jones Metal Working Machines



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And yet you want them to be up to scratch—better, if anything, than ever.

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25, 50, 100, 250 and 500 lb. models

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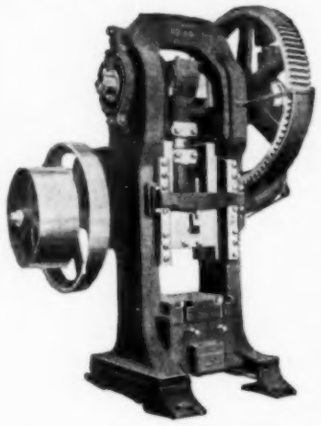

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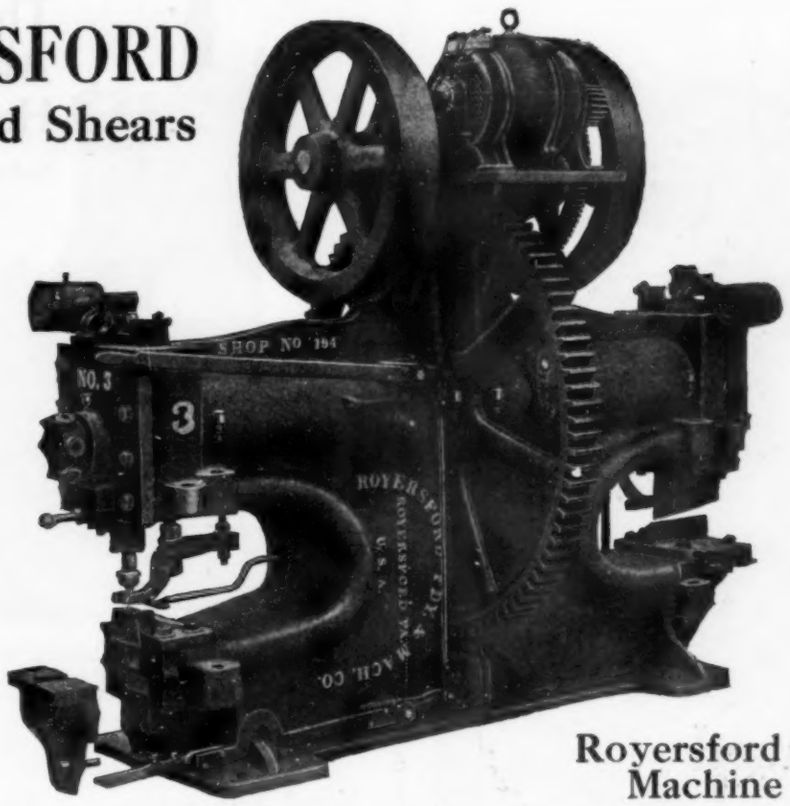

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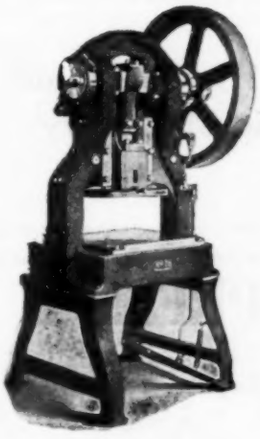

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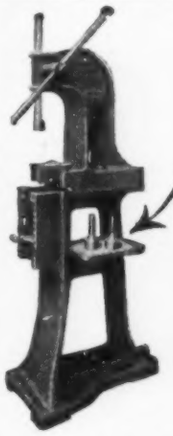

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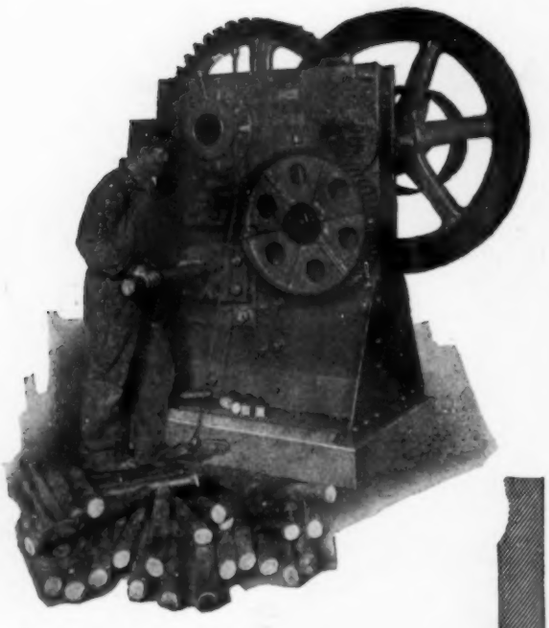

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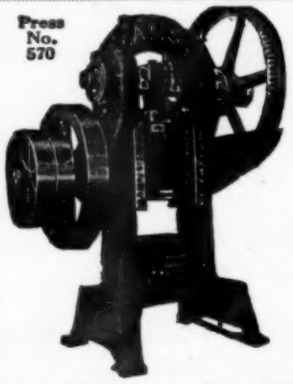

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Large or small Regular or Special

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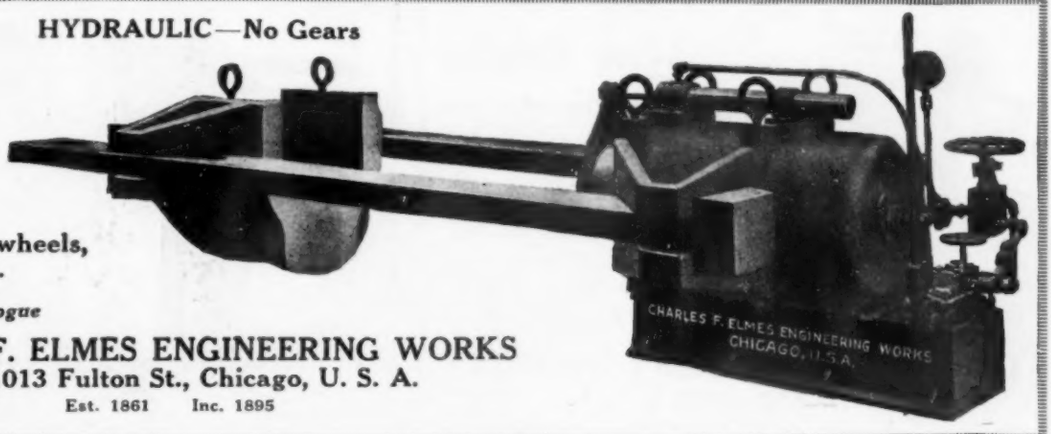

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For crank pins, wheels, gears, etc.

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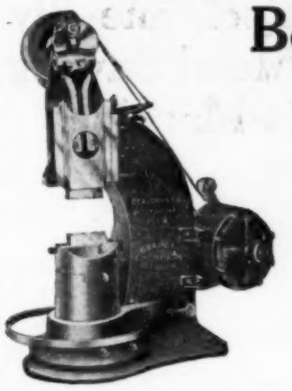

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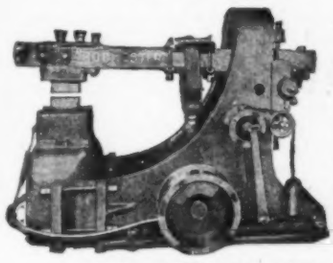

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FOR CUTTING, FORMING, PUNCHING, DRAWING AND EMBOSSING BAR AND SHEET METALS, PAPER, LEATHER ETC.

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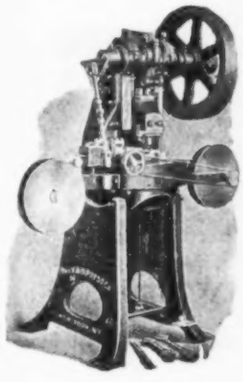

Stamp Out Your Metal Blanks With a V & O Press

Automatic feed attachment permits stamping small metal blanks at a rapid rate.

The stock and scrap rolls are made integral with the press. No wasted, cluttered-up floor space.

Write for Bulletin A-6

The V & O Press Co.
Glendale, Brooklyn, N. Y.

ATLAS Presses

There is nothing to offset the saving when you invest in an Atlas Press. You get two presses for the cost of one when you install Atlas Presses. **Write for the Atlas Bulletins.**

Atlas Press Co., 317 N. Park St., Kalamazoo, Mich., U. S. A.

START TO ECONOMIZE

It costs considerable to replace lost and ruined tools. Get a "Gerstner" Case and you'll be money in at the end of the year. Select one from our free catalog showing many styles of guaranteed Tool Cases. **Write for Catalog.**

A. Gerstner & Sons. Manufacturers of Mechanics' High Grade Tool Cases

25-31 Columbia St.. DAYTON, OHIO

Titeflex

REG. U.S. PAT. OFF.

The ONLY All-Metal hose and tubing made from metal strip.

Titeflex has no sliding joints to provide flexibility and no packing is required to make **Titeflex** tight.

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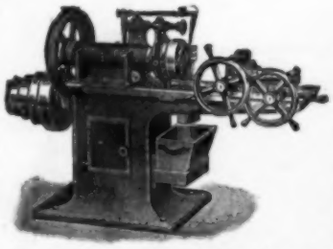
TITEFLEX METAL HOSE CORPORATION
Badger Ave. and Runyon St., Newark, N. J.

Watch for this mark

Fairbanks Morse Co.

MACHINE TOOL DEPARTMENT
30 Church Street — New York City



Acme Results

mean faster work, lower cost of operation and less time consumption on Bolt Cutting and Pointing, Nut Tapping, Bolt and Rivet Heading, Forging, Rotary Thread Rolling, etc. Acme Machines are unequaled for work of that sort, and Acme results are worth getting. Catalog?

THE ACME MACHINERY COMPANY
CLEVELAND, OHIO, U. S. A.

Plain Shears Nos. 3 and 4

HERCULES

Once A Myth
Now A Reality

Hercules Shears are a powerful and convenient tool for cutting bars and sheets of iron and mild steel. Mounted easily—machine to the job or vise versa. Blades have draw-in cut with no tendency to crowd work out of shear. Cam pivoting with handle makes contact with a roll directly over cutting point. Steel band slung over this cam lifts the upper blade of jaws, the lower blade being stationary. No. 3 Shears cut bars and sheets of iron, mild steel, copper, brass, card, fibre and straw board ¾ in. and under; No. 4 Shears cut same materials ⅞ in. and under.

W. A. & C. F. Tucker
Hartford, Conn.

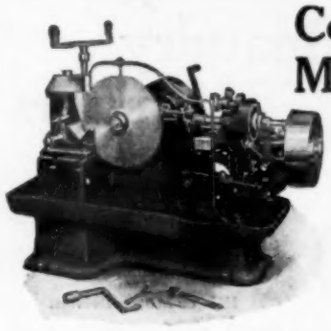
HUNTER SAWS

The name Hunter on a saw is an absolute guarantee of quality, workmanship and the ability to handle the toughest saw jobs.

Hot Saws, Friction Discs, Solid Blades made from Vanadium, Tungsten and Chrome Alloy Steels. Saw Sharpening Machines, Inserted Tooth Grinders, Hardened Steel Specialties.

We also manufacture and carry in stock a full line of rivet sets and chisel blanks.

Hunter Saw & Machine Co.
Pittsburgh, Pa.



Cochrane-Bly Metal Sawing Machines

6 Sizes.

Capacities to 12-in. bars.

Feeds up to 2 in. per min.

Send for circulars.

Cochrane-Bly Co., Rochester, N.Y.

The

HIGLEY

Cold Metal Saw

Catalog will be sent on application to

Vandyck Churchill Company
93 Liberty Street, New York

PRESSES and SHEARS

Sheet Metal Working Machinery

THE D. H. STOLL CO., Inc.
Military Road and Lansing St., Buffalo, N. Y.

"Peerless" High-Speed Metal Saws

Increase Production by

Automatic Feed
Automatic Lifting Device
Improved Blade Tightener
Straight Line Pull
Positive Blade Holder
Quick Acting Vise
Hand Scraped Guides
"T" Slotted Bed.

They are automatic, accurate, economical
For further details write directly to us.

Peerless Machine Company, Racine, Wis.

QUALITY Hack Saws

TUNGSTEN STEEL

Standard for a Generation. The high-speed blade among hack saws.
Made in "Flexible" as well as "Hard" in Hand sizes. "Hard" only in Power Machine sizes.

NAPIER SAW WORKS, Inc. *Home Office and Factory*, SPRINGFIELD, MASS.

THE "RACINE"

HIGH SPEED METAL CUTTING MACHINE

Use "Racine" H. S. Tungsten Blades

Standard the World Over

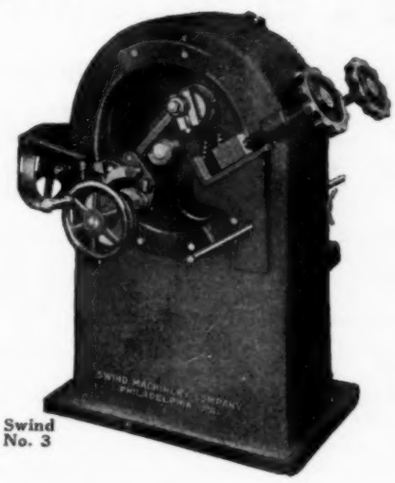
Made by the largest exclusive manufacturers of High Speed Metal Cutting Machines, THE "RACINE" has proven its ability to set records for accuracy, speed and economy in hundreds of representative plants.

Quality in design, construction and performance is attained without lessening the highest standards of economical operation.

We'll demonstrate on your work.

Racine Tool & Machine Company
1400 Jones Ave.
Racine, Wisconsin

A Practical Cutting-Off Machine That is Moderate in Price



Swind No. 3

The Correct Saw Speed

The correct saw speed is found automatically. A good investment for the New Year.

May your New Year be bright and full of prosperity.

Swind Machinery Company
Widener Bldg., Philadelphia, Pa.

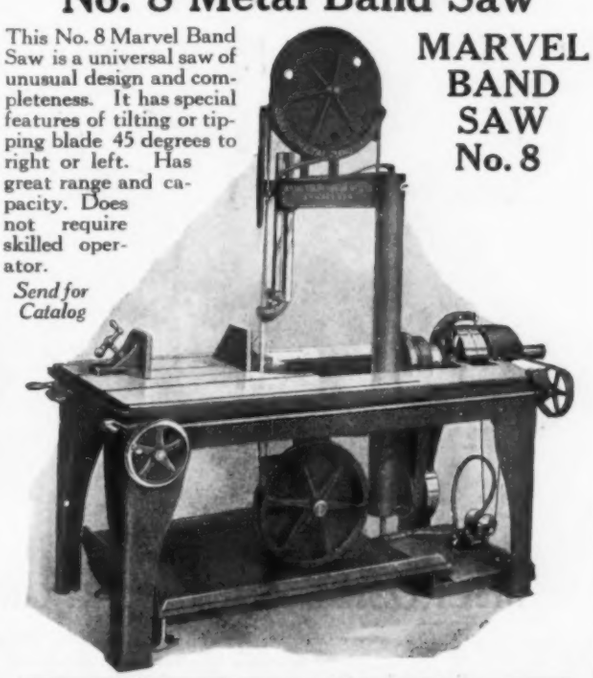
MARVEL

No. 8 Metal Band Saw

This No. 8 Marvel Band Saw is a universal saw of unusual design and completeness. It has special features of tilting or tipping blade 45 degrees to right or left. Has great range and capacity. Does not require skilled operator.

Send for Catalog

MARVEL BAND SAW No. 8



Armstrong-Blum Mfg. Co.
347 N. Francisco Street, Chicago, Ill.

WE now turn our back on the old year and begin to get ready to swear off a few things. One of the best little "swear offs" you can make at this time is to get rid of your old-style, inefficient chucks and insist on

SWEETLAND CHUCKS

They are as practical on the roughest forging as on the finest spindle and once set-up, they hang on till the piece is finished. If you produce certain duplicate parts the **Sweetland** will save the price of an expensive jig. A slight "easing up" on two of the jaws releases the part, a new one is inserted, and the jaws are "set-up" again. The position of the piece is always the same.

Get the full details and start the year right.

The Hoggson & Pettis Manufacturing Co.

New Haven, Conn., U. S. A.

Go Ahead!
SPEED WHERE IT COUNTS

Production Per Press Per Minute

A Typical Wizard Outfit

will prove to you that

McCrosky Wizard Chucks and Collets

are not mere attachments but vital producing parts of your Drill Presses. They enable the operator to go ahead and keep going until the job is done, no matter how many operations it includes, or how many different tools are used.

The McCrosky Wizard Chuck has a powerful, positive drive, backward as well as forward. It transmits the full power of the Drill Press spindle, but is under perfect control for changing tools.

If you need greater production per press, per minute, investigate the advantages of a McCrosky Wizard Outfit.

McCrosky Catalog has full details. Send for a copy today.

McCROSKY TOOL CORPORATION, Meadville, Pa., U. S. A.

Branches: Detroit Chicago Cleveland San Francisco

Agencies in other principal cities.

Export Agents: Benjamin Whittaker, Inc., 21 State St., New York;
Benjamin Whittaker, Ltd., 56 Ludgate Hill, London E. C. 4

McCrosky
COST CUTTING TOOLS

BARKER WRENCHLESS CHUCK

Plants that adopt the Barker Wrenchless Chuck attain, on the average, from 25 to 75 per cent increase in their lathe production.

The Barker Wrenchless is *not* a power-operated chuck. It is designed on a simple cam and trunnion principle of movement, which gives instant action, enormous pressure, and accurate centering.

Write to US for information concerning the Barker Wrenchless Chuck. We are its original manufacturers and guarantors.

THOMAS ELEVATOR COMPANY

27 South Hoyne Ave., Chicago

ALMOND

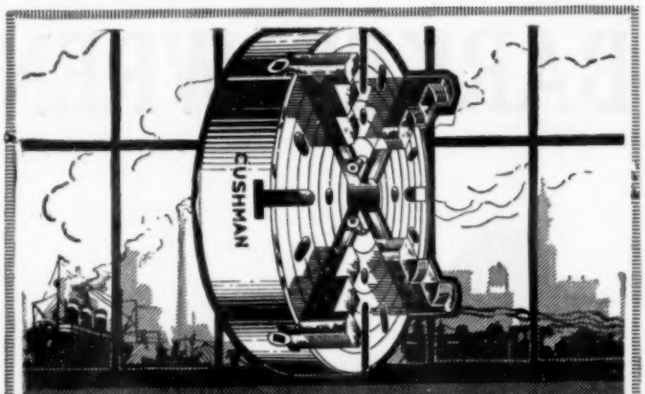
All Almond Micrometers are inspected and adjusted to Johansson Gages and recognize comparison only with these gages.

Almond Service—Should the Micrometer need readjusting at any time or defect in material or workmanship develop send to Ashburnham and readjustment or replacement will be made without expense.

OTHER **ALMOND** PRODUCTS

Drill Chucks, Right Angle Transmission, Lathe Chucks, Flexible Steel Tubing

T. R. ALMOND MFG. CO.
Ashburnham, Mass.



THE CHUCK WITH A REPUTATION TO MAINTAIN

"CUSHMAN" CHUCKS 1862

THE CUSHMAN CHUCK CO.
HARTFORD, CONN.

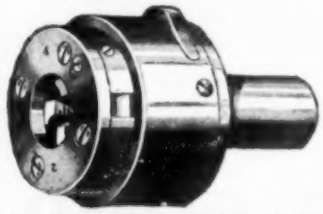
H&G

Screw Machine Products

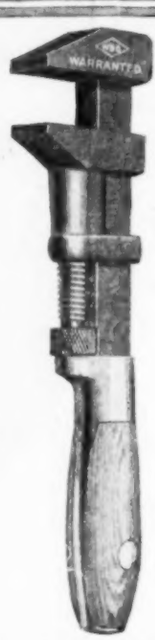
PERHAPS you buy your screw machine products outside. In that event, we would like to let you know what we can do. Our low manufacturing costs enable us to make attractive quotations. Prices submitted on blueprints or samples.

We operate one of the six largest screw shops in the country. To increase the production and the quality of our own work we built the H & G Die Head. The manufacture of this die head is now the most important branch of our industry, so you can rest assured it is a good one.

We believe it is the best self-opening die head on the market and if you will write us for details we will tell you of our shop test plan.



H & G WORKS—THE EASTERN MACHINE SCREW CORP.
20-40 Barclay St., New Haven, Conn.

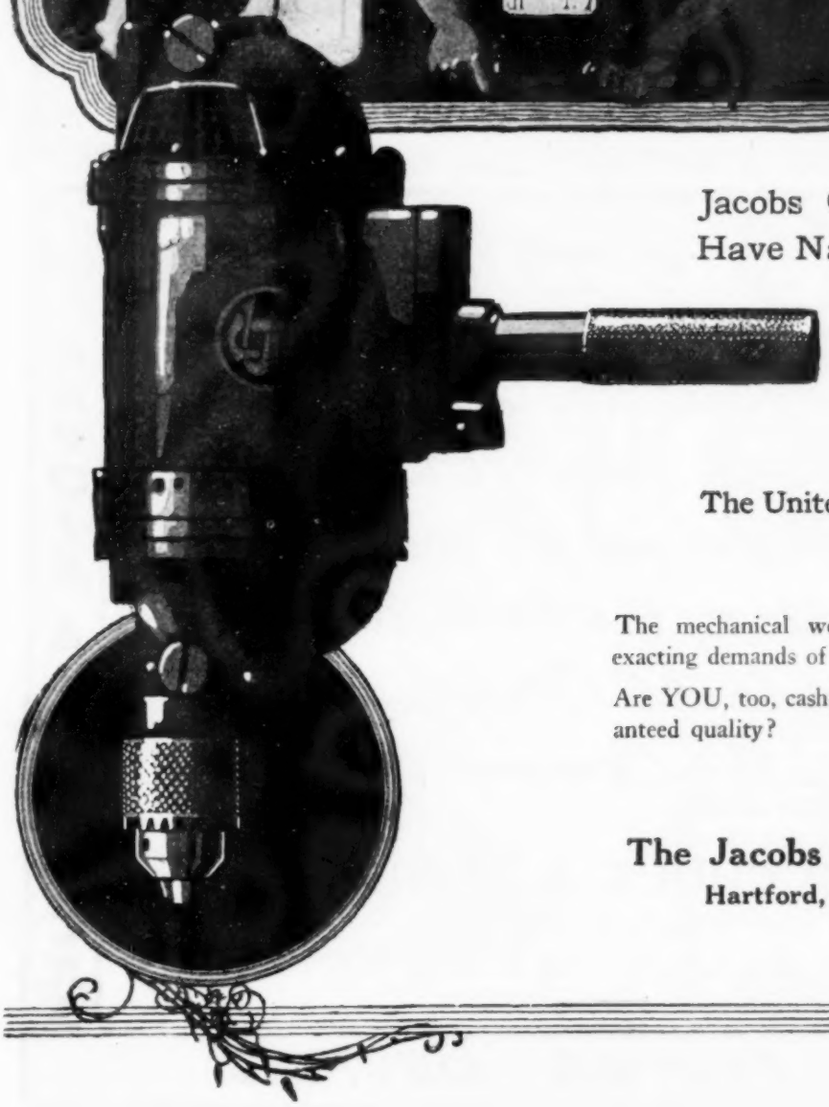


Better Tools make better workmen

Ask for our catalog of Superior Drop-Forged Tools.

J. H. WILLIAMS & CO.
"The Wrench People"

BROOKLYN 35 Richards St. BUFFALO 35 Vulcan St. CHICAGO 1035 W. 120th St.



Jacobs Quality Chucks
Have Naturally Become

Standard Equipment

for

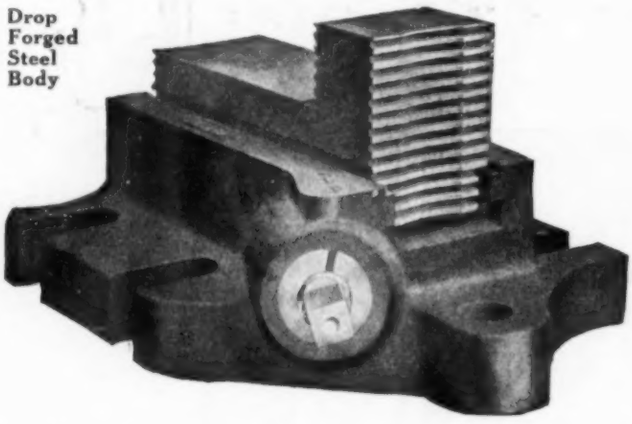
The United States Electric Tool Company's
Portable Drills.

The mechanical world is conversant with their exacting demands of superiority.

Are YOU, too, cashing in on Jacob's supreme guaranteed quality?

The Jacobs Mfg. Co.
Hartford, Conn.

Drop Forged Steel Body



It Will Hold

if it's a

BULLARD

Independent Face Plate Jaw
Type XAP-2
(Patented)

Heavy face plate work requires adequate holding members. That's why **Bullard Independent Face Plate Jaws** are chosen for boring mills, lathes and planers.

STEEL BODY. Drop forging, accurately machined and assembled to sliding jaw and operating screw.

TOP JAW. Drop forging. Special chuck jaw steel, heat treated and hardened to withstand severe usage without fracture or distortion.

DIFFERENTIAL ACTUATING SCREW. Alloy steel, heat treated and hardened on square ends. Angular relation of screw with rack in sliding jaw provides a powerful differential which exerts maximum gripping pressure and at the same time serves to lock the jaw. It also eliminates the usual tendency of chuck jaws to loosen or "slack-off" under the strain and vibration of the cut.

LOW BASE. The angular disposement of actuating screw reduces the total height of base and jaw and permits the gripping of work with the minimum of overhang from table or face plate.

SECURING BOLTS. Bullard Jaws may be used with any machine having either straight, radial or parallel T-slots. An adjustment of securing-bolt centers is provided for in the construction. As illustrated, no tongue or key is necessary.

Orders should specify "Type XAP-2" and should be accompanied by dimensional sketch of T-Slots.

Immediate Deliveries

The Bullard Machine Tool Co., Bridgeport, Conn.

1920—1921

LAVOIE AIR CHUCKS

We extend, to you, Our Very Best Wishes for a Happy and Prosperous New Year We sincerely thank you for your Hearty Co-operation during the Past Year, and look forward to the Continuance of same during the Coming Year —

LAVOIE AIR CHUCKS

FRONTIER CHUCK & TOOL CO.

BUFFALO, N. Y.

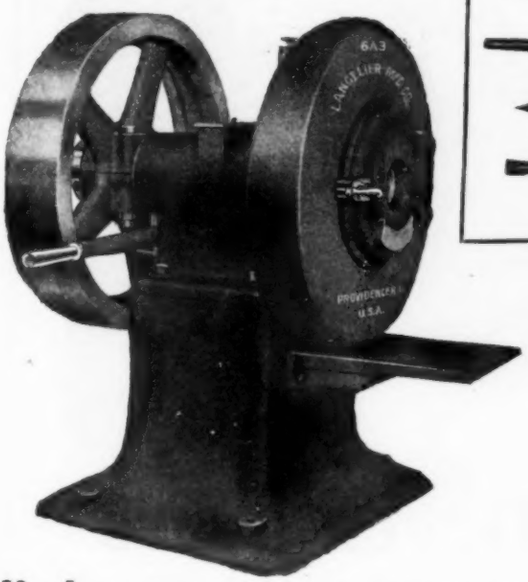
Agents: W. E. Cole, Detroit; R. R. Street & Co.; Chicago; Bauschke Machinery Co., Cleveland; Thompson Machinery Co., Pittsburgh; C. W. Frillman, Dayton, Ohio; H. A. Wright, Boston; Stuart Sales Co., Philadelphia

LABOR SAVING DEVICES

Rotary Swaging

for Heavy and Light Duty

Will accurately form metal with economy



SAMPLES OF HOT SWAGING

The Langelier Reducing or Swaging Machine forms different metals without wasting any of the material. It improves the stock by compression, besides preserving same metal on the surface—the best metal, which with any other machine is cut away. In addition to this big economical feature, it is more accurate and more rapid.

In working extremely hard metal, we arrange **these machines to swage the metal hot**, doing much of the work formerly done by trip hammers at a very much higher rate of production, with unskilled labor, at lower cost and with greater accuracy.

3000 Blows a Minute Must Mean Rapid Work

Revolving dies are within the round casting in front. These dies are forced on the work by a succession of sharp blows from the hammer blocks behind the dies. These striking at the rate of about 3,000 blows a minute reduce the material, such as drill rod, tubing, copper, etc., with great rapidity. The machine is perfected to give absolutely uniform and well finished work.

A Special Machine for Your Special Work

We build these machines in eight different sizes to take solid stock from pin wire up to 2 inches dia. and tubing up to 4 inches dia. We will study your work and build machines especially for it, to be operated by unskilled labor, producing the blow best adapted to secure the desired results, according to the nature of the material to be worked, its size and amount of reduction and whether solid or hollow, **hot** or **cold.**

Write and tell us about the work you want done—sending samples or blueprints

LANGELIER MFG. CO.

Arlington, Cranston, R. I., U. S. A.

ETTCO DRILL CHUCKS

For 1921

Eastern Tube & Tool Co.
Brooklyn, N. Y.

Ellison Hardened Body Drill Chucks

THE NUT is hardened and ground and has accurate acme threads.

Please accept our best wishes for a bright, prosperous New Year.

The American Machine Company
104 Wellington Ave.
Hartford, Conn.

GARVIN HEX-SQUARE TWO-WAY FIXTURE

For Butt or Straddle milling of a square or hexagon nature.

Will clamp in either a horizontal or vertical position.

Made in two sizes:
1 in. size, ½ to 1 in. cap.
2 in. size, ¼ to 2 in. cap.

MANUFACTURED BY

THE GARVIN MACHINE COMPANY

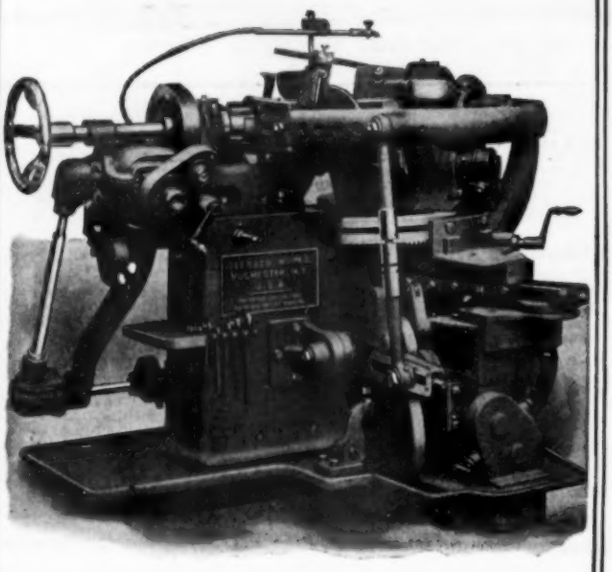
Spring and Varick Sts. 50 Years in NEW YORK CITY

Horton Chucks

If better, more dependable chucks are ever made, HORTON will *still* make them, and there will *still* be a type for every chucking need.

The E. Horton & Son Co.
Windsor Locks, Conn.
109-12

GLEASON
Spiral Pinion Rougher



Fills the Need

of manufacturers for a machine to rough out pinions faster than a regular finishing machine.

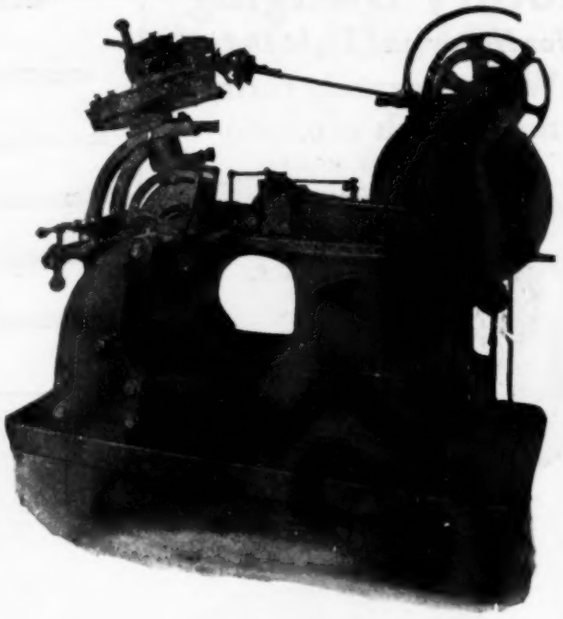
This roughing machine is UNIVERSAL, being adapted for roughing right or left-handed spiral type pinions. Also FULLY AUTOMATIC.

Positive index mechanism is actuated by the generating roll of the work spindle. Adjustments are quickly made.

GLEASON

GLEASON WORKS
Rochester, New York

BEVEL GEAR GENERATORS

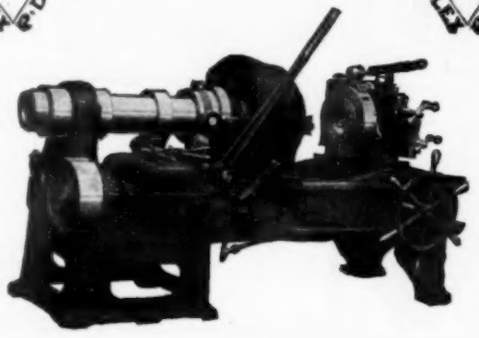


Bevel Gears

are cut by us theoretically correct, and so are adapted to fine machinery of all kinds. We have special facilities for cutting SPUR, WORM, SPIRAL, MITRE, INTERNAL and ELLIPTICAL Gear Wheels. Let us quote on your specifications.

The Bilgram Machine Works 1233 Spring Garden St. Philadelphia, Pa.

PEERLESS B&K DUPLEX P·D·Q·D



Rapid and Accurate Pipe Threading

Is the kind done by B & K Pipe Threading Machines. They work with remarkable rapidity and ease of operation. Every thread is clean and accurate. Every machine is equipped with the Peerless Die Head. Made in nine sizes, each size having a capacity of 8 to 10 sizes of pipe.

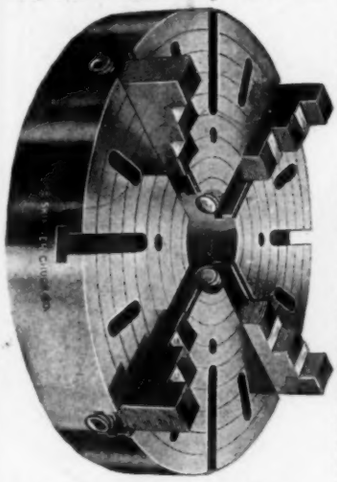
Write for complete catalog

Bignall & Keeler Machine Works

Edwardsville, Ill.

Strong Chucks—

That truly describes Skinner Steel Body Independent Lathe Chucks. They are not only strong and powerful, but wonderfully accurate. The



SKINNER Steel Body Independent Lathe Chuck

is a single steel casting of great strength, well proportioned and accurately finished. Face is graduated accurately in inches. Screws and bearings are made of the toughest steel to withstand abnormally hard wear.

The dependability of Skinner Steel Body Independent Lathe Chucks is conclusively proved by the fact that not one has ever been known to break in service—and we have been making them for many years.

4-Jaw Independent Chuck, Steel Body, for Heavy Duty

Write for catalogue and illustrated literature.

THE SKINNER CHUCK COMPANY

NEW BRITAIN, CONN. U.S.A.

ESTABLISHED 1887

New York Office 94 Reade St.

San Francisco Office Rialto Bldg.

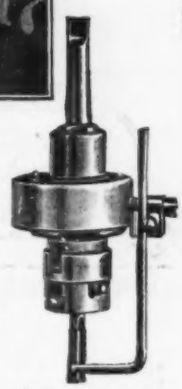
London Office 139 Queen Victoria St., London, E. C. 4.

Errington Auto Reverse Friction Tapper

Style C.

Tapping Blind Holes in Air Cooled Automobile Cylinder

(AMERICAN MACHINIST. Mar. 14, 1907.)



The breakage of a single tap on this job would cause an intolerable blemish in the appearance of the piece and result in heavy loss in time and money. The **Errington Sensitive Adjustment and Quick Reverse** insure perfect results. Regulate the power of the machine to **just** drive and remove all danger of **breaking the tool or injuring the work** Fool proof, fits any drill press, and taps steel as safely as cast iron. Seven sizes, $\frac{3}{8}$" to 2".

Errington Mechanical Laboratory

Broadway & John St., New York City

Phone Cortlandt 3149 136 West Lake St., Chicago

"WearEver" Spacing Collars for Milling Machines

"WearEver" Spacing Collars eliminate the delays between jobs. They have made the old practice of cutting paper shims obsolete in a large, constantly increasing number of big shops.

The "WearEver" collar is adjustable in increments of .002 in. over a range of .024 in. There are no threads to cause trouble; adjustment is positive; faces are always true and parallel. Collar is thin and can be used in close quarters.

Sent on free trial.

Scully-Jones & Co.
649 Railway Exch. Bldg.
CHICAGO

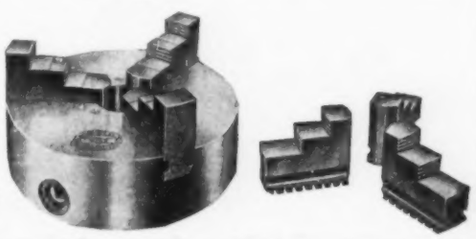
Union Geared Scroll Chucks

with two separate sets of jaws

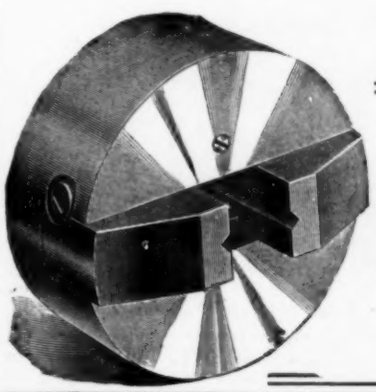
NO. 153

Buy and use a Scroll Chuck (Universal) with two separate sets of jaws. You are then equipped with inside and outside jaws for universal chucking.

Union Mfg. Co.
New Britain Conn.
26 Cortlandt St., N. Y.



Thrust Shoulders of Whiton Chucks are of Hardened Steel



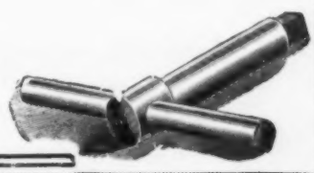
The hardened thrust shoulders, made to Whiton's particular specifications, take care of all the rough work, and allow greater safe capacity, size for size, than other chucks. The screw thread extends fully to the outside of the chuck.

A WHITON CHUCK NEVER SLIPS

D. E. Whiton Machine Co., New London, Conn.

Europe: Selson Engineering Co., Ltd., 85 Queen Victoria St., London, E. C.

"Whiton" Chucks are sold and kept in stock by principal dealers all over Europe.



POWER PLUS STRENGTH

Power plus strength, more of each than ever offered in a vise before, makes this quick acting vise an unusually good buy!

The upper lever is mounted on an eccentric which gives the jaws a grip sufficient to hold any work.

The cam-faced lower lever gives the jaws their quick action. Both levers can be operated at the same time with one hand.

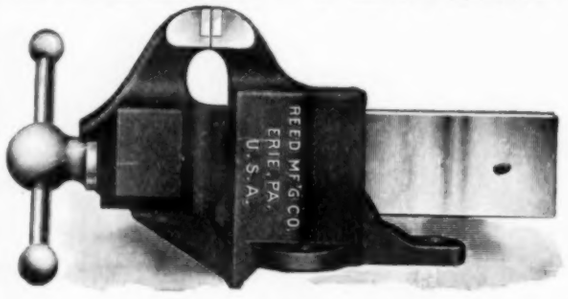
This vise gets its strength because all parts are steel drop forgings except the base which is of special iron. Fitting surfaces are ground and parts are interchangeable.

Prices, etc., upon request.

The Hartford Special Machinery Co.
280 Homestead Ave., Hartford, Conn.

HARTFORD SPECIAL
The Shop of a Hundred Experts
MACHINERY COMPANY

REED VISES



We Avoid "Wiggle and Wobble"

—between sliding bar and body by machining both to close limits, so there is bearing over all contact areas. This, also, distributes wear which accounts largely for the satisfactory service of Reed Vises for many, many years.

Send for catalog and pamphlets.

Reed Manufacturing Co.
Erie, Pa.

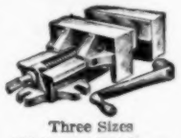
KNURL HOLDER

Two Sizes
For Turret Machines
Adjustable to knurl all work up to 2½-in. diameter.

Great Britain — Burton, Griffiths & Co.
France, Italy, Switzerland, Spain and Holland— Fenwick Freres & Co.

High Speed Drilling Attachment or
DRILL SPEEDER
Three Sizes

DRILL VISE

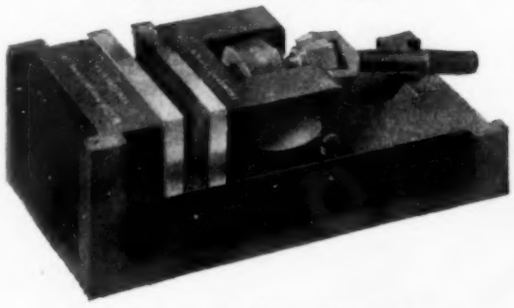


Three Sizes
With and Without Jig Attachments
Often used on miller, shaper or planer.

Send for circulars.

The Graham Mfg. Co.
Providence, R. I.

Nestor Vises for 1921



Please accept our best wishes for a Happy and Prosperous New Year
NESTOR MFG. COMPANY, Inc.
40 West 13th St., New York City

We Wish You

A Happy

and

Prosperous New Year

BUT!

You will be more

PROSPEROUS

and consequently, much

HAPPIER

If you have a Complete Equipment of

Universal Angle Plates

Boston Scale & Machine Co.

100 Ruggles Street, Boston, Mass.

Agents for Great Britain, Belgium, Italy, India, Burmah and Ceylon, Japan, Formosa and Korea: Alfred Herbert, Ltd., Coventry, England.

Thrift is Wise Spending—Try It On Vises

The "Starrett" Line of Improved Vises are more economical than ordinary vises for two big reasons: Their several time- and labor-saving features, and their durable construction.

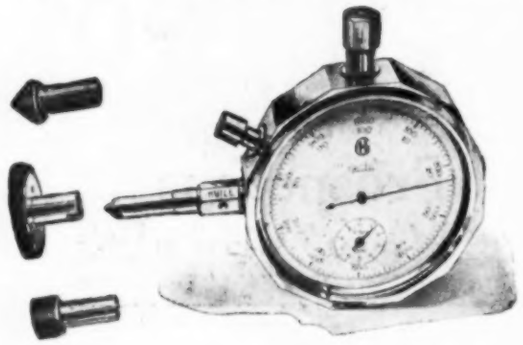
These points are being explained in detail in our series of weekly advertisements. If you want the whole story, however, in handy form get a copy of our 60-page Catalog.

Thrift is wise spending—try it on vises.

Athol Machine Company
Athol, Mass.

The Improved "Starrett' Vise

Lower Production Costs!



TASLER SPEED INDICATORS

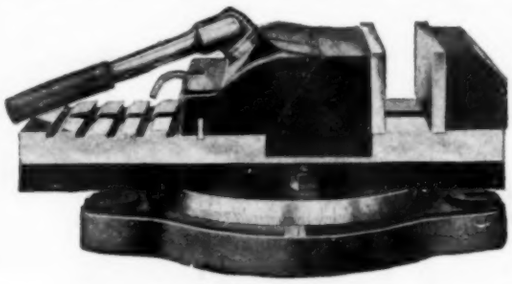
"The World's Most Accurate"

USED BY THE LARGEST COMPANIES IN AMERICA

Send for Complete Information Today.

C. H. Boulin

82 Duane Street **New York**



NELSON Quick-Acting Vises

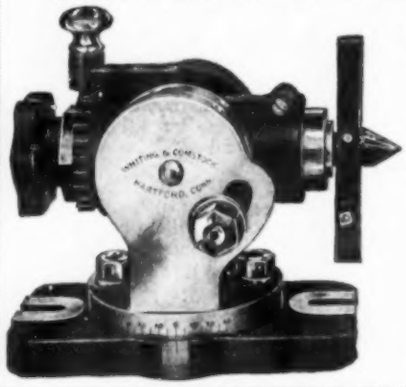
On the Nelson Improved Quick-Acting Machine Vise, pressure is applied through the medium of a square threaded screw. This screw acts on a two-faced wedge and forces the working jaw forward and down at the same time. This is only one of the many features which make the Nelson Vise a real labor and time saver.

Nelson Vises are made of hard cast iron with steel faced jaws, hardened and ground. They may be had in three sizes—jaw widths of 4, 6 and 8 inches and with either plain or swivel base.

Write for further particulars.

The Nelson Tool & Machine Co.
82 Lewellen Ave.
Bloomfield, New Jersey

Saves Time on Small Milling Jobs



by using a plain milling machine, equipped with our

Semi-Universal Dividing Head

a simple, absolutely accurate piece of equipment which is needed in every shop.

Write for details.

Whiting & Comstock
Hartford, Conn.

Export Dept., 77 Broad St., New York City.

Unvarying Efficiency

Weston

Model :

Portable Direct Current Instruments

are permanent magnet, movable coil instruments which are particularly adapted for the precise measurement of current and voltage.

Their accuracy is within ¼ of 1 per cent of full scale value under all practical working conditions.

They are provided with legible scales, having mirrors over which the knife-edge pointers travel, thus facilitating reading.

These Instruments are regularly furnished as Ammeters, Voltmeters, Milliammeters, Millivoltmeters and Microammeters.

Bulletin 501 sent upon request. Write for it.

Weston Electrical Instrument Co.
17 Weston Ave., Newark, N. J.

Branches in All Principal Cities of the U. S.

Model 1
Portable D.C. Ammeter

—and throughout the world.

Make Your Profit Keep Pace with Your Costs

Cost tendencies are upward. Therefore, keener attention to details is necessary to prevent profit losses. *Know* every operation—let your men know too—and you can avoid raising prices and yet keep your present profit margin.

Put a Productimeter where it will tell you, tell your superintendent, your foremen, and your workmen, all the vital **figures** that prevent cost from eating up profit.

Ask for our Catalog 33.

The Productimeter is more than a machine—it's a service—a service that aims to give you, and your men, the **immediate** figures of quantity; that puts pep and ambition into them and profit into your pocket.

DURANT MANUFACTURING CO.
Milwaukee, Wis. (1063)

Greater Accuracy At Less Cost

Showing Locking Screw on Reversible Ends

Tests prove that Johansson reversible end Tolerance Plug Gages save $.08 on every 100 holes inspected. Let us send a blue print showing how you can make this saving.

Johansson ACCURACY

C. E. Johansson, Inc.
Poughkeepsie, N. Y.

ULTIMATELY A BURY "UNIVERSAL" 3-CYLINDER AIR COMPRESSOR. WHY NOT INSTALL ONE NOW?

Durable as the Pyramids
All Sizes
All Types
All Pressures
For All Requirements

Silent as the Sphinx

Bury Universal Pyramid Duplex

Bury Compressor Co., 1800-1900 Cascade St., Erie, Pa., U.S.A.

HACK **"STERLING"** SAWS

Diamond Saw & Stamping Works, Buffalo, N. Y.

Gray's Sheet Metal Cutter Cuts Shapes Like These

Made in four sizes for cutting shapes from ⅛, ¼, ⅜ and ½-inch plate.

W J. SAVAGE COMPANY, Inc.
Knoxville, Tenn.

"MILFORD" HACK SAW BLADES

"Go By The Name"

Sample sent on request
The HENRY G. THOMPSON & SON CO., NEW HAVEN. CONN.

The Principle is *Right!* That's Why a FORBES' "Threads Pipe Accurately"

You've seen two men swinging on the handles of a die stock to thread a 2-in. pipe! I've done it many a time, before we got this Forbes'.

Now suppose these men locked their die stock in a vise and put their Stillsons on the pipe. Suppose they turned the pipe instead of the die stock!

Man, *think*—if it takes two men to turn a little die stock weighing 10 lbs., will it be any easier to turn a length of 2-in. pipe, weight 200 lbs.?

No, sir — it won't. So that's why the Forbes' *locks the pipe still and turns the dies.* That's why a Forbes' cuts better, faster, and takes less power. That's why a Forbes' is a real economy.

Make it your new economy by telling us the range of pipe sizes you use. Then we'll specify a Forbes' to fit your requirements.

CURTIS & CURTIS CO.
321 Garden St., Bridgeport, Conn., U. S. A.

FOREIGN AGENCIES:
Anderson, Meyer & Co., Ltd., of China, Shanghai, China; Horne Company, Ltd., Tokyo, Japan; Aktiebolaget Sigfr. Anderson & Co., Malmo, Goteborg, Scandinavia and Stockholm, Sweden.

2040-K

FORBES'
IT THREADS PIPE ACCURATELY

Scleroscope
International Standard
(Hardness Tester)

HARDNESS TESTING
is now done almost exclusively with
The Scleroscope

DIRECT READING, can be operated by anyone with rapidity; measures softest metals and hardest steels without adjustment. Is the only instrument that properly agrees with others of its kind, and is used for ordering material to specification. Send for our booklet, free.

The Pyroscope

is the common-sense heat measuring instrument that makes straight for results, without fuss. It costs least of all, burns simple kerosene, never varies. It is the available trusty in the grimy hands of furnaceman, hardeners and carburizers. It is a pet in the laboratory, and preferred by colleges. Interesting bulletin free.

Pyroscope
(Temperature

SELECTIVE CARBURIZING and HARDENING
By SHORE PROCESS

SHORE INSTRUMENT & MFG. COMPANY
Van Wyck Ave. and Carrol St., Jamaica, N. Y.

Foreign Agents:
Agents for Italy, Great Britain and Colonies: Coats Machine Tool Co., Ltd., 14 Palmer St., London, S. W. Ignosskoff, Suckau & Co., Petrograd, Russia. Aux Forges de Vulcain, Paris, France. H. E. Stokvis & Zonen, Ltd., Belgium and Holland. Yamatake & Co., Tokyo, Japan.

Randall & Stickney
Indicators and Gauges

for every kind of precision measurements on duplicate parts. Quickly and easily applied. Unsurpassed in simplicity and durability.

Calibrated in thousandths of an inch or metric scale. Ideal for the rapid, accurate inspection of large quantities of work. No modern shop should be without them.

Write us today.

Randall & Stickney
Waltham, Mass. U. S. A.

Horstmann Indicating Calipers

guide the work in the shop as the compass guides the ship at sea. There's too much at stake to make approximate estimates.

Let us show you how efficient this caliper is.

Write for Bulletin.

See your fit—don't feel for it.

The F. W. Horstmann Co.
Irvington, Newark, N. J.

SIMPLEX Precision Surface Plate

Just the right size for use on a bench in laying out or inspecting machine parts and special tools.

It is well ribbed so as to preserve its original shape and accuracy.

The top is specially heavy and can be repeatedly scraped. Guaranteed to be perfectly flat.

Sizes	Price Planed	Price Scraped
13 x 15	$18.50	$34.50
12 x 20	23.00	42.50
20 x 30	57.50	103.50
36 x 40	115.00	172.50

Mail us your orders.

The Simplex Tool Company, Woonsocket, R. I.

LOVEJOY
Inserted Cutter Tools

These tools are of the positive lock type. They never slip. As rigid as solid tools and much more economical. Ask for the "Lovejoy Catalog."

Lovejoy Tool Co., Inc., Springfield, Vermont

DOMESTIC AGENTS: The Chadwick Co., 35 So. Dearborn St., Chicago, Ill. A. V. Wiggins & Co., 384 West Fayette St., Syracuse, N. Y. **FOREIGN AGENTS (For British Isles):** Selby Engineering Co., 6 Broad St. Place, London, E. C. 2. **For France, Belgium and Spain:** F. Auberty & Co., 93 Rue de Maubeuge, Paris, France.

WATCH FOR OUR NEXT AD. ON THE **PRESTOMETER** FLUID GAUGE
COATS MACHINE TOOL COMPANY Inc
110-112 West 40 Street, New York N. Y.

Charles Engelhard
the original Le Chatelier
Pyrometers
30 Church St., New York City

Brown
PYROMETERS · THERMOMETERS
RECORDING INSTRUMENTS
The Brown Instrument Co.-Philadelphia

OLIVER OF ADRIAN
Filing, Sawing and Lapping Machines

Made in two styles—Bench and Pedestal. They are suitable for work on dies, templates, gauges. They are simple and easy to operate. Excellent machines for general shop use. **Literature on request.**

OLIVER INSTRUMENT CO., Adrian, Mich.

DRILLS Will Write Much of Your Record for 1921

Since a larger per cent of shop operations have to do with drilling than any other activity, the choice of efficient drills is one of your most serious problems.

The difference between ordering drills by size and price, and ordering Buckeye Drills, may be the difference between profit and loss. At any rate, there is a big difference in the ***quality***—and the margin is in favor of the scientifically tempered, always-accurate "Buckeyes."

You'll probably write more business on the right side of the ledger, if you start by selecting the right tools.

BUCKEYE

Twist Drills, Reamers and Special Tools

The Buckeye Twist Drill Co.

Alliance, Ohio

New York Office: 50 Church St.
Chicago Office: 26 South Jefferson St.

The Trimo Pipe Wrench
Made with Wood Handles in 6-in., 8-in., 10-in. and 14-in. Sizes; with Steel Handles in All Sizes.

With Flat-Link or Cable Chain Trimo Chain Wrench
In 8 Sizes for ⅛-in. to 15-in. Pipe.

Trimo Nut Wrench
6-in., 8-in., 10-in., 12-in., 15-in., 18-in. and 21-in. Sizes. Especially Suitable for Railroads

Trimo Pipe Cutter
In 3 Sizes, Cutting from ⅛-in. to 3-in. Pipe.

TRIMO

The Word Trimo

stands for good tools made by the Trimont Mfg. Co., which are the following:

The Trimo Pipe Wrench
The Trimo Chain Pipe Wrench
The Trimo Monkey Wrench
The Trimo Pipe Cutter (Hand)
Sold at Same Price as Others

The Four Good Points

that make the ***Trimo Pipe Wrenches*** superior are the ***Spiral Spring*** always in place—***Steel Frames*** that will not break—***Nut Guards*** that protect adjustment nut—and the ***Inserted Jaw in handle*** that can be replaced when worn. ***Save money*** and buy Trimo goods, made by

Trimont Mfg. Co.

Roxbury, Mass., U. S. A.

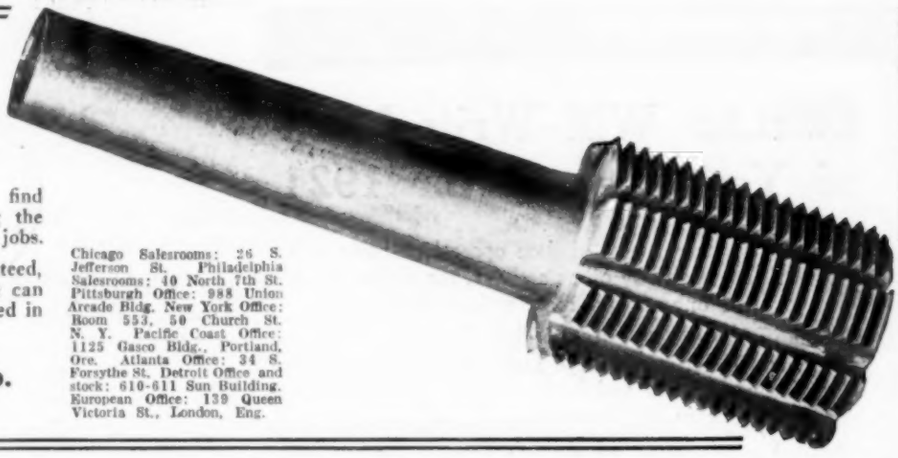
"N. C." TOOLS

are standard in every industry

Wherever you go, you generally find National Cleveland Tools carrying the responsibility of different cutting jobs.

They are made by experts, guaranteed, and backed by the best service that can be provided. They are fully described in our monthly list. *Do you get it?*

The National Tool Co.
Cleveland, Ohio



Chicago Salesrooms: 28 S. Jefferson St. Philadelphia Salesrooms: 40 North 7th St. Pittsburgh Office: 988 Union Arcade Bldg. New York Office: Room 553, 50 Church St. N. Y. Pacific Coast Office: 1125 Gasco Bldg., Portland, Ore. Atlanta Office: 34 S. Forsythe St. Detroit Office and stock: 610-611 Sun Building. European Office: 139 Queen Victoria St., London, Eng.

REAMERS

bearing this trade-mark

R.&T. CO.

are made to "Do the Job Right" and save the user money.

That's the only excuse for their being so persistently brought to your attention.

Keystone Reamer & Tool Company
Millersburg, Pennsylvania
Chicago, 180 N. Market St.
New York, 30 Warren St.

USE SUPER-SIX EXPANSION REAMERS

Ready—every minute of the working day—to ream any sized hole from $\frac{15}{32}$" to $1\frac{17}{32}$" to micrometer limits of tolerance. A turn or two of the binding nuts is all that's needed to set a Critchley Improved SUPER-SIX Expansion Reamer. No individual blade screws to bother with.

Ask your dealer—and write for descriptive price list.

115-22

Cutter & Wood Supply Co.
60 PEARL STREET
BOSTON 9, MASS.

How Much Time Do You Lose

hunting for the drill you want? Most of this time could be saved if you had one of the various drill containers made by the

Morse Twist Drill & Machine Co.
New Bedford, Mass., U. S. A.

These vary from the Folding Stand shown here to the Revolving stand for Morse Taper Drills. Each Drill is always in its proper place.

Salvage Your Old Files

Files are rarely worn out when thrown in the scrap but no process of saving, heretofore, has proven entirely satisfactory.

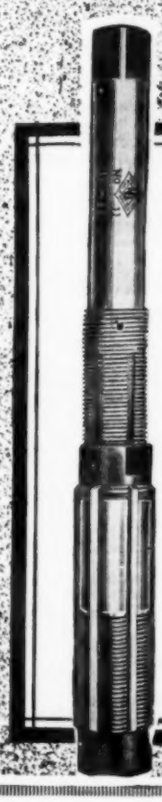
We have developed a method of resharpening both new and old files from which most satisfactory results are being secured. During a period of readjustment such as we are now passing through is a good time to make the discards of other times show value.

We will resharpen your old files at a fraction of the cost of new and the files so treated will be (unless the teeth are actually worn off in which event we scrap the files making due allowance to the customer) nearly equal to new and often they will cut better and last longer than new files.

May we have the opportunity of telling you more of our process and treat a few dozen files for you?

The Grover File Company
Nashua, N. H.

New Britain
Expansion Reamers
"CRITCHLEY IMPROVED"

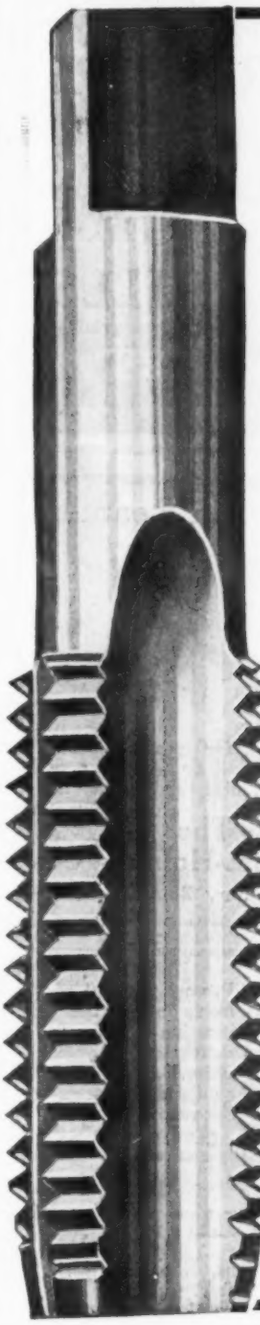


Ream Smooth true holes

Unlike most expansion reamers, New Britain Expansion Reamers have an even number of blades, which require only a micrometer to set them to any desired size. Once set the blades will not loosen or slip, thus accurate reaming is assured. The blades are made of the finest quality of either High-Speed or Carbon Steel as desired and are interchangeable. Made in 17 sizes; the smallest will expand $\frac{1}{16}$ in. and the largest $\frac{9}{16}$ in.

Write for complete details

The New Britain Tool & Mfg. Co.
New Britain, Conn., U. S. A.



Butterfield

A Tap that will help you keep those New Year's Resolutions

Among your resolutions, didn't you resolve you were going to do even better work in 1921 than you did in 1920—and didn't you vow you'd have to cut expenses somewhere along the line? We thought so.

As far as thread cutting goes, you can carry out your resolution as to improving workmanship by installing Butterfield Taps—the taps that are backed by 35 years of superiority in making good work better.

As for costs—you'll find that tap breakage will be almost zero, tap-grinding will take less time, and your production per hour will go up. Of course your costs will go down.

Why not start 1921 by sending for a trial order o Butterfield Taps?

Butterfield & Company
Division Union Twist Drill Company
Derby Line, Vt., U. S. A.

Chicago, 11 So. Clinton St. Toronto, 220 King St., West. Montreal, 131 St. Paul St., West

DOMESTIC REPRESENTATIVES: New York City, T. P. Walls Tool & Supply Co., 75 Walker St.; Pittsburgh, Somers, Fitler & Todd Co., 327 Water St.; Philadelphia, Diamond Specialty & Supply Co., 1225 Arch St.; St. Louis, Handlan-Buck Mfg. Co.; Cincinnati, J. R. Wood Supply Co., 917 Broadway; Buffalo, H. D. Taylor Co., 99 Oak St.; Detroit, W. T. Baird Machinery Co., N. E. Cor. Jefferson and Brush Sts.; Indianapolis, Vonnegut Machinery Co., 43 Meridian St.

FOREIGN REPRESENTATIVES: Great Britain ,Geo. H. Alexander, 83-84 Coleshill St. London, England; France, Italy, Belgium and Switzerland, Fenwick Freres, 8 Rue de Rocroy, Paris; Sweden, Norway and Denmark, Ab. Sigfr. Anderson & Co., Malmo; Spain, Cassamitjana Hermanos, Barcelona; Japan, Abe-Kobel & Co., Yokohoma; Greece, Stephen C. Stephanson, 11 Lycourgan St., Athens; Netherlands, Wynmalen & Hausman, Rotterdam; Australia, H. R. Richardson, 82 Pitt St., Vickery's Chambers, Sydney; South America, Charles Dreyfuss, B. Milre, 785, Buenos Aires, R. A.

CARBON AND HIGH SPEED
TWIST DRILLS AND REAMERS

TRADE W&B MARK

"HERCULES"

HIGH SPEED DRILLS

The Whitman & Barnes Mfg. Co. Established 67 Years
AKRON, OHIO
TWIST DRILLS—REAMERS—FOR EVERY INDUSTRY

WHY NOT?

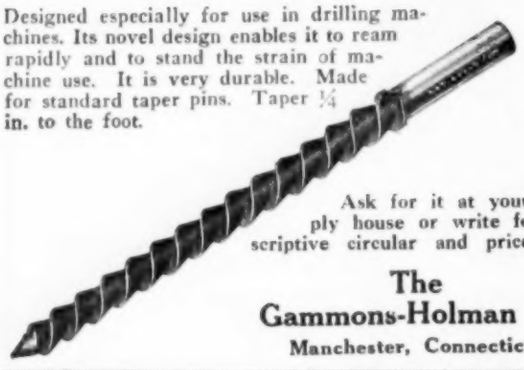
install this die for accurate threads at a fast rate of production.

CHASERS can be furnished in time for your requirements.

THE IDEAL TOOL & MFG. CO.
BEAVER FALLS, PA.

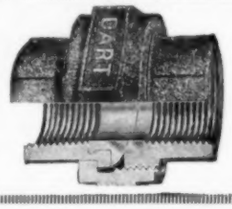
The Gammons Taper Pin Reamer

Designed especially for use in drilling machines. Its novel design enables it to ream rapidly and to stand the strain of machine use. It is very durable. Made for standard taper pins. Taper ¼ in. to the foot.



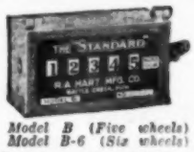
Ask for it at your supply house or write for descriptive circular and price list.

The Gammons-Holman Co.
Manchester, Connecticut



Absolutely Tight

non-corrosive bronze seats accurately ground together make Dart Unions non-leaking. A free sample on request. Write for catalog and price list No. 20.
E. M. Dart Mfg. Co. Providence R. I.
The Fairbanks Co., Sales Agents
Canadian Factory, Dart Union Co., Ltd. Toronto.
Ask your dealer for prices



Model B (Five wheels)
Model B-6 (Six wheels)

Model B Gear Counter

will give you your accurate production. Tested 20,000 per hour

Send for circular

R. A. HART MFG. CO., 191 WILSON COURT BATTLE CREEK, MICH.

1/16 to 5 inches

TAPS

Prompt quotations made on your specification — prompt deliveries on your order. Latest equipment throughout plant.

THE GARDNER-BRYAN CO., CLEVELAND

The Model D Shop Engraving Machine

All special engraving machines and supplies

Manufactured by

Engravers & Printers Machinery Co.
Sag Harbor, N. Y.

SEND for KELLY

On all boring and reamer operations, line bar work, etc., Kelly Production Tools will satisfy. Catalog sent on request. A representative in your territory.

The Kelly Reamer Co., Cleveland O.

We are equipped to fill your stamping requirements, and to insure your obtaining the quality and service desired.

Send for our Catalog—mail us your inquiries

KALES STAMPING COMPANY

453 Lafayette Blvd., West Detroit, Mich.

Canadian Plant Walkerville, Ont.

BEFORE BUYING a keyseating machine send for descriptive Circular-B covering our new No. A-Keyseater. It has several decided improvements which will interest you.

We make prompt deliveries on keyseat cutters.

Sizes ⅛-in to 1¼-in Carbon or H. S. Steel. Special sizes on order.

C. F. DAVIS MACHINE CO., Inc.
133 Andrews St., Rochester, N. Y.

Oliver Fibre-Faced Hammers

are head and shoulders above those made of brass, lead or other soft metal, because they wear evenly and are as good at the finish as at the start of service. Worn faces quickly replaced. Prices are right. Descriptive circular for the asking.

W. W. Oliver Mfg. Co.
1480 Niagara Street, Buffalo, New York

TWIST DRILLS, CUTTERS, REAMERS AND SPECIAL TOOLS

NATIONAL TWIST DRILL & TOOL CO.
DETROIT, U.S.A.

NO. 100R Set of 10 PUNCHES

5—Drive Pin Punches. 1—Pin Starting Punch, ⅛ in. point. 1—Prick Punch. 3 sizes Center Punches, all 4" long, in Cloth Container. Order of your Tool Dealers.

Made by The West Haven Mfg. Co., New Haven, Conn

Vixen Files Are Fast Workers

—outwear ordinary files

Each tooth of a Vixen File is individually *machined* from the smooth, solid metal. The Vixen-curve teeth automatically produce the diagonal stroke that *cuts* instead of scraping. You realize what this means to you and your men on production speed. And besides, the Vixen-curve sheds filings no matter how greasy the material—keeps teeth clean—avoids the delays caused by the clogging of ordinary files.

Because they give a longer period of service, and can be resharpened many times, Vixens are preferred by shopmen and production experts. Severe use has proved Vixen File economy.

Write for information and prices.

VIXEN TOOL CO.
Newark, N. J.

VIXEN FILES

Don't throw away the entire reamer when the blade breaks. Use the **RICH 69-C Two-piece Reamer** and get real reamer economy. One shank will outlast a dozen blades.

Write for prices of blades and shanks and estimate the saving

Rich Tool Co.
504 Railway Exchange
CHICAGO

BENNETT'S
Combined Drills and Countersinks

Made of either semi-high-speed or high-speed steel. We specialize on this line of tools and guarantee them to be accurate and of the best quality of steel and workmanship. Also a full line of hand and machine reamers.

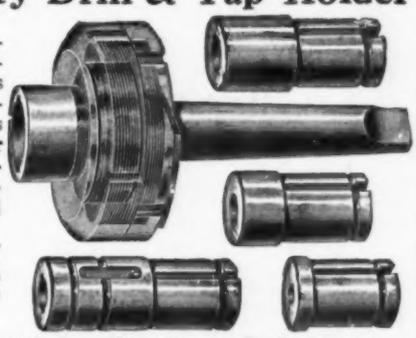
If you want the best tools of this kind possible to make write today for our Catalog and Price List.

BENNETT TOOL CO., Wrentham Mass., U. S. A.

The Safety Drill & Tap Holder

is the only attachment for the purpose that gives universal satisfaction and is **Unequaled for Efficiency, Convenience, Rapidity, Accuracy and Simplicity.**

Nothing to *break* or get out of *order*. Made in 4 sizes covering from 0 to 2½ in. diameter.



The Beaman & Smith Co., Providence, R. I., U. S. A.
Builders of Boring and Milling Machines, and Special Machines for such Purposes Constructed

FASTFEED

TWIST DRILLS CUTTERS REAMERS END MILLS
SEE NEXT WEEK'S ISSUE
FASTFEED DRILL AND TOOL CORPORATION
TOLEDO, OHIO

HILO
Hilo Lite Gray Machinery Enamel
painted on machinery brings sunlight walls nearer to the operator.
A Hilo Service Salesman Will Tell You More About It.
Hilo Varnish Corporation
Brooklyn, N. Y. Chicago, Ill.

Twist Drills—Reamers—Milling Cutters
THE STANDARD TOOL CO.
Cleveland, Ohio, U. S. A.

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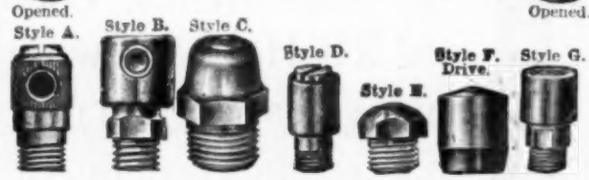
Tucker Oil Hole Covers will help make things run along more smoothly for you in 1921.



W. A. & C. F. TUCKER, Hartford, Conn., U. S. A.

FOREIGN AGENTS: Fenwick Freres & Co., Paris, France
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CLEANS

Put your Cleaning Problems up to us.

OAKLEY CHEMICAL CO.
24 THAMES STREET · NEW YORK

Protect Your Bearings with

The Patented "Conus" spring cover, a feature found only in "Conus" Oil Cups

CONUS

Oil Cups

Made of high-grade Swedish Steel heavily nickeled. Installed without tapping.

Simple—efficient—economical

Ask for catalog and sample

American Galco, Inc.

Dept. A Grand Central Palace, New York, N. Y.

THE HINGE

GITS OIL CUPS

Give perfect satisfaction where others fail. State style and size in which you are interested, and we will send free samples and catalog.

Gits Bros. Mfg. Co.
1940 S. Kilbourne Ave., Chicago

FOR DEPENDABILITY, SERVICE AND ECONOMY

EMPRESS
GREASE and OIL CUPS

No. 73

Should be standard lubricator equipment on your Machine Tools

BOWEN PRODUCTS CORP. Reg. U.S. Pat. Off.

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MINNEAPOLIS DIV.,
MINNEAPOLIS, MINN.
CANADIAN WINKLEY CO., LTD.
WINDSOR, ONTARIO

WRITE FOR CATALOG H

It shows the EMPRESS line—complete

SUN OILS

Sun Emulso
Sun Automatic Cutting Oil
Sun Pipe Threading Oil
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Watch for our full page "ad" every second week of each month

SUN COMPANY, Philadelphia

Aladdin's Lamp
has nothing on the
"Searchlight"

When an advertiser sells equipment for over $4,000.00 through "Searchlight" advertising that cost $12.00, we think "Searchlight" is at least entitled to "favorable mention."

615

Searchlight Section

Employment — Equipment — Business Opportunities

HELP THE OTHER FELLOW

THERE are certain parts of your product that can be manufactured cheaper in specialty plants. Look over the list of advertisers in this Section. See how well they are fitted to handle your work. They have the machines and mechanics—pass along the work. They can suit your most exacting tastes.

CONTRACT WORK SECTION

Why technical men hold themselves back

"A great many engineers are unconsciously holding themselves in check because they fail to grasp business principles."

—John A. Harrington, of the Executive Committee, American Association of Engineers.

WHAT Mr Harrington and other engineering authorities are saying about the importance of business training for technical men, the Alexander Hamilton Institute began emphasizing years ago.

The Institute was founded by a group or business leaders who recognized that modern business was training specialists but was not developing executives in proportion to the constantly increasing demand.

From the first it has been an axiom with the officers of the Institute that "a technical man is the ideal Institute man"; and that axiom has proved itself in the fact that out of the army of men whom the Institute has enrolled one in ten is a man of technical training or interest.

The men of whom presidents and general managers are made

Just what is it that the Institute has done for these thousands of engineers and technical men. Let us illustrate very specifically:

You are an engineer, a chemist, a draughtsman, a master-mechanic—in a word, a man who has reached his present position in business thru specialized training of one sort or another.

You can see your way clearly to a place at the head of your department; but beyond that what does business have in store for you?

Do you know the fundamentals of accounting? Of merchandising and advertising; of factory and office organization; of business law and corporation finance?

These fundamentals a man *must* know if he is to direct an organization, or engage in business for himself.

And it is precisely these essentials that the Institute—thru its Modern Business Course and Service—undertakes to give—not in years, but in the spare moments of a few months.

No man could run thru the letters

contained in the Institute's files without feeling that here is an opportunity which every man of technical training ought to investigate, at least.

Here is a sentence from the chief engineer of a great port city, for example: *"I know of nothing that could tend more towards the advancement of an engineer on any line of work than a thoro study of Modern Business."*

And another from a resident engineer, of a giant engineering company: *"The engineering profession is broadening, and men trained as engineers are more and more being used in business where their technical education gives them an excellent groundwork."*

"Your training enabled me to effect economies in my work which I had not dreamed of before," says a prominent electrical engineer. And other men, in every phase of technical work, are on record with equal positiveness and enthusiasm.

To save the wasted years

The Alexander Hamilton Institute has only one Course and one product—trained executives. It does not claim to be able to transform failures into successes; its interest is with the man who would ultimately score a fair measure of success even without its help.

To such a man it says: "There is a shorter road to one of the important positions in business than merely routine experience; thousands of men have proved that truth thru their own experience and success.

"You know better than anyone else what a year of your life is worth. But if the Alexander Hamilton Institute can save five years for you that would otherwise be lost in a routine job, or three years or even one, surely that promise is worth your investigation."

Investigation is easy; you have merely to send for

"Forging Ahead in Business"

Forging Ahead in Business is a book of 116 pages. Into it have gone the results of years' experience in helping men to success. It answers every question you can raise about the Alexander Hamilton Institute; it contains letters from men whose positions in business were very similar to yours. It is a book that should be in every man's library, and there is a copy for every man of serious purpose. It is sent without obligation; send for your copy today.

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BRAZED SEAM
OILERS
for
the Machinery Trade

Made of heavy steel with strong welded seams—can be subjected to extreme heat without danger of loosening seams.

Write us about your requirements.

Gem Manufacturing Co.
PITTSBURGH, PA.

Bennett Oil Hole Covers

are self-closing. Dust and grit are not permitted to score the bearings. It is a simple matter to adjust one of the covers. Drill the oil hole of proper size and insert the cover by a little pressure.

It is economical, convenient, and does not interfere with proper cleaning.

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Write in for a free sample quantity of Minolard, the universal Cutting Oil. A trial will prove its value. Just send us a postal today for the *free trial quantity.*

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F F

FISKE'S

LUBRICANTS

Do You Know That

No matter where you are, whether in South America, Australia or Europe you will be able to obtain our specialties from our agents in those territories.

SLUSHING COMPOUND

Our FISKE'S SLUSHING COMPOUND as well as our other anti-rust specialties will absolutely prevent corrosion and protect the surface of the equipment coated. A most severe test made by one of the largest concerns again proved this to their, to our own and to everybody else's satisfaction.

BUT YOU CAN PROVE IT FOR YOURSELF

FISKE BROTHERS REFINING COMPANY

24 STATE ST., NEW YORK CITY

76 Esther St. NEWARK, N. J.

PLANTS:

215 Pontiac St. TOLEDO, OHIO

F F

Re-MANUFACTURED -(ORIGINATED BY US)- MACHINE TOOLS

RE-MANUFACTURED Machine Tools must pass the most strenuous tests that can possibly be imposed upon Machine Tools before being "stamped" with the Hill-Clarke Guarantee.

Not only are Re-Manufactured Machines completely restored in appearance and productive powers, but in the event that the original machine was inaccurate when it was made, alignment errors are *corrected* in Re-Manufacturing. In such cases the Re-Manufactured Tool is actually better than when new.

Follow the precedent of manufacturers who would not be satisfied with so-called "rebuilt" tools—buy Re-Manufactured Machines, not because they are less expensive, but because they are

Dependably Accurate

A Snapshot of one section of our Re-Manufacturing Plant

LATHES

1—3 x 60-in. Fitchburg Lo-Swing.
8—8 x 60-in. Fitchburg Lo-Swing.
1—8 x 84-in. Fitchburg Lo-Swing.
1—Bridgeford Hvy. Duty Dbl. End Axle.
31—14-in. x 6-ft. Reed Ext. Hvy. Pl. Turning.
7—16-in. x 6-ft. Reed.
1—16-in. x 7-ft. Reed.
12—17-in. x 6-ft. LeBlond Mfgrs. Auto.
21—18-in. x 8-ft. Boye & Emmes, belt feed.
8—18-in. x 8-ft. Boye & Emmes, Q.C.G.
1—18-in. x 10-ft. Whitcomb-Blaisdell, Gd. Hd.
21—18-in. x 8-ft. LeBlond, Q.C.G., C.R.
28—19-in. x 8-ft. LeBlond Hex. car. turret.
31—19-in. x 8-ft. LeBlond, P. F. turret.
14—20-in. x 8-ft. LeBlond C.R., Q.C.G.
97—20-in. x 8-ft. American, C.R., Q.C.G.
12—20-in. x 8-ft. American, P. F., turret.
3—20-in. x 8-ft. American, motor arrangement.
3—20-in. x 10-ft. Lodge & Shipley, Gd. Hd.
18—21-in. x 10-ft. LeBlond, C.R., Q.C.G.
34—21-in. x 10-ft. LeBlond, carr. turret.
19—22-in. x 8-ft. Davenport.
1—22-in. x 8-ft. Lodge & Shipley, motor arrangement.
9—25-in. x 10-ft. LeBlond, C.R., Q.C.G.
13—26-in. x 9-ft. Bridgeford, C.R., Q.C.G.
105—26-in. x 10-ft. Bridgeford, C.R., Q.C.G.
23—26-in. x 12-ft. Bridgeford, C.R., Q.C.G.
2—26-in. x 16-ft. Bridgeford, C.R., Q.C.G.
2—26-in. x 18-ft. Bridgeford, C.R., Q.C.G.
2—26-in. x 20-ft. Bridgeford, C.R., Q.C.G.
32—26-in. x 10-ft. Niles-Bement-Pond, C.R., Q.C.G.
1—26-in. x 12-ft. Walcott, C.R., Q.C.G.
1—26-in. x 12-ft. Wickes, C.R.
1—26-in. x 12-ft. Putnam, C.R., semi-Q.C.G.
3—26-in. x 12-ft. Putnam, motor drive.
1—29-in. x 14-ft. Walcott, C.R., Q.C.G.
6—30-in. x 11-ft. American, Gd. Hd.
1—30-in. x 20-ft. American, Gd. Hd.
2—30-in. x 11-ft. Houston, Stanwood & Gamble.
1—30-in. x 12-ft. American.
19—32-in. x 12-ft. Pittsburgh, C.R., Q.C.G.
3—36-in. x 14-ft. Johnson, Trip. Gd.
2—36-in. x 19-ft. Johnson, Trip. Gd.
4—36-in. x 37-ft. Niles-Bement-Pond, Gd. Hd.
5—40-in. x 12-ft. Fifield, Trip. Gd.
1—40-in. x 18-ft. Fifield, Trip. Gd.
2—45-in. x 24-ft. Pond, Trip. Gd.

UPRIGHT DRILLS AND RADIALS

3—No. 6-B spdl. Henry & Wright Sens.
1—20-in. Silver Sliding Hd., complete.
1—20-in. Silver Sliding Hd. Wheel, lever feed.
1—23-in. Rockford B.G., P.F.
1—25-in. Silver Sliding Hd., complete.
4—3-ft. American Sens. Radial.

BORING MILLS

1—10-in. Niles Vertical.
1—3 ¼-in. bar Binsse Hor.
1—Beaman & Smith Hor., 2 hds.
1—2-spdl. Espen Lucas, 2 hds.

SHAPERS AND PLANERS

2—20-in. Niles-Bement-Pond.
4—26-in. Niles-Bement-Pond, motor drive.
4—26-in. Niles-Bement-Pond, motor arrangement.
2—26-in. Niles-Bement-Pond, belt drive.
2—26-in. Kelley, B.G.
2—36 x 13-in. x 14-ft. Niles-Bement-Pond Frog and Switch.
1—56 x 56-in. x 10-ft. Gray, 2 hds.
1—72 x 72-in. x 14-ft. Niles Planer, 4 hds.
1—96 x 72-in. x 20-ft. Bement-Miles, 4 hds

MILLERS

54—No. 6 Whitney Hand.
62—Garragus Hand.
23—Van Norman Hand.
26—No. 4 Loew Victor Lincoln.
24—No. 12 Pratt & Whitney, Lincoln.
42—No. 7-H Becker Lincoln.
2—Type B-34-in. Briggs.
2—12-in. Pratt & Whitney Semi-Automatic.
2—18-in. Cincinnati Automatic.
1—26-in. x 8-ft. Ingersoll, 2 hds. motor.
1—17-in. x 10-ft. Beaman & Smith 3 hds.
1—30-in. x 12-ft. Newton Slab, 2 spdls.
1—48-in. x 10-ft. Newton Slab.
3—No. 2 Pratt & Whitney Hand.
1—No. 2 Chicago Hand, P. F.
62—No. 3 ½ Fox P.F.
1—Knight Drill and Milling.
1—No. 1 Dow Pl.
1—No. 2 Brown & Sharpe Vertical.
2—No. 4-B Becker Vertical.
123—No. 4 Hendy Lincoln.
2—No. 4 Cincinnati Pl. S.P.D.

TURRET AND SCREW MACHINES

2—3-A Warner & Swasey
2—20-in. Pratt & Whitney, Gd. Hd. Chucking.
39—24-in. Steinle Turret.
1—24-in. Gisholt.
1—1-in. Pratt & Whitney Screw.
3—2-in. Pratt & Whitney Screw.
15—No. 2 Warner & Swasey Screw
5—No. 2 Foster Screw.
3—No. 4 Warner & Swasey Screw.
19—No. 4 Wood Turret Screw.
4—No. 1 ½ Southworth Screw.
4—No. 75 4-spdl. National Acme Automatics.
1—No. 6 Brown & Sharpe.

GRINDERS

12—American Drill.
1—No. 2 Garvin Hole.
1—No. 70 Heald Int.
1—No. 10 Brown & Sharpe Pl.
1—12 x 36-in. Landis Pl.
1—12 x 96-in. Landis Pl.
1—No. 2 Bath Surface.
1—8 x 48-ft. Thompson Surface.

OUR GUARANTEE:

YOUR MONEY BACK IF YOU RETURN MACHINE WITHIN 30 DAYS OF DATE OF SHIPMENT, FREIGHT PREPAID

NO EXCUSES NECESSARY!

HILL, CLARKE & CO. OF CHICAGO

649 WASHINGTON LVD.

You're offered here the kind of used equipment that's "right"

LATHES

Fay & Scott 18-in. x 8-ft., CR, Reg. Equip.
Seneca Falls 13-in. x 6-ft. latest type, chuck.
Putnam 14-in. x 8-ft., Reg. Equip., with chuck.
Perkins 15-in. x 8-ft., 1-3/16-in. hollow spdl.
Blaisdell 16-in. x 6-ft., Reg. Equip., chuck.
Seneca Falls 16-in. x 6-ft., Semi QC., C.R.
Blaisdell 13-in. x 6-ft., Elev. Rest, 2 chucks.
Lodge & Shipley 18-in. x 10-ft., QCG, Reg. Equip.
Putnam 14-in. x 7-ft., Reg. Equip., chuck.
American 16-in. x 6-ft., SBG, with chuck.
LeBlond 16-in. x 10-ft., act. swing 17-in.
Blaisdell 17-in. x 8-ft., Pl. Rest, C/S.
Bullard 19-in. x 6-ft., Elev. Rest.
Bradford 20-in. x 8-ft., CR, Pl. Chg., Reg. Equip.

GRINDERS

Saxon, Vertical Type, Cylinder.
Capital Internal, 3/16-in. to 2-in. x 2-in.
Pratt & Whitney 6-in. x 48-in. Plain, Reg. Equip.
Landis 12-in. x 120-in. Plain.
Modern 12-in. x 36-in. Plain.
Brown & Sharpe No. 11 Plain.
Norton No. 1 Plain.
Reid Bros. No. 2 Auto Surface.
Pratt & Whitney 12-in. x 36-in. Vert. Surface.
Brown & Sharpe No. 3 Univ., 12-in. x 40-in.
Landis No. 3 Univ., 12-in. x 42-in.
Cady 12-in. x 2-in. Wet Tool, with stone.

MILLING MACHINES

Cincinnati No. 3 Vertical High Power.
Cincinnati No. 4 Vertical High Power.
Brown & Sharpe No. 7, Plain, 47-in. table.
Davis & Egan No. 0, Power Feed.
Knight No. 2 Comb. Drill and Mill., P.F.
Becker No. 25 Plain, Vise and C/S.
Van Norman No. 5 Hand, on column.
M & C No. 2 Hand, Bench, Reg. Equip.
Milwaukee No. 1 Plain, BG.
American No. 0, Open Bed.
Brown & Sharpe No. 5 Vertical, Reg. Equip.
Brainerd No. 21 Plain, Knee Type, BG.
Cincinnati 18-in. Plain, BG Reg. Equip.
Brainerd No. 3 Back Geared, Plain.

SCREW MACHINES

Gridley 2¼-in. cap. Auto., 4 spindle.
National-Acme No. 515, 4 spindle, Auto.
National-Acme No. 55, 4 spindle, Auto.
P & W ¼-in.cap., Sgl. spindle, Auto.
P & W No. 1 Hand, 7/16-in. Cap., latest pat.
B & S No. 1, ½-in. cap., wire feed.
Foster No. 1 Hand, 13/16-in. cap., Reg. Equip.
Garvin 1-in. cap. Hand, AC, set of collets.
Foster No. 2 Hand, 1-1/6-in. cap., Reg. Equip.
Garvin No. 2, Pl. Hd., 1-1/8-in. cap., Reg. Equip.
Wood No. 4, 1½-in. cap., Fric. Grd. Hd., Reg. Equip.
P & W 1½-in. x 18-in. Hand.

MISCELLANEOUS

Grant 18-in. Semi-Univ. Radial Drill.
Pratt & Whitney 24-in. Sta. Hd., Upright Drill.
Fitchburg 12-in. Traverse Head Shaper.
Gould & Eberhardt 15-in. Single Geared Crank Shaper.
Putnam 20-in. x 20-in. x 5-ft. Planer, Reg. Equip. with shoe.
Woodward & Powell 24-in. x 24-in. x 6-ft., sgl. Hd., on Rail.

LYND-FARQUHAR COMPANY

Machine Tools of Quality

Dept. "C," BOSTON 9, MASS.

NEW AND USED MACHINE TOOLS

PRESSES

No. 12 Bliss Hand Screw Press.
No. 1 Bliss Arch Screw Press.
No. 4-A Standard S. A. Power Press.
No. 5-A Standard S. A. Power Press.
S. A. Power Press, 3½ in. stroke.
S. A. Power Press, 8 in. stroke.
No. 1 Broaching and Drawing Press.
No. 9 Manville Knuckle Joint Press.
No. 4 Blake & Johnson Embossing Press.
100 lb. Standard Plain Drop.
200 lb. Standard Plain Drop.
200 lb. Standard Automatic Drop.
800 lb. Standard Automatic Drop.

PLANERS

20 x 20 x 4 ft. Thayer & Houghton.
17 x 20 x 5 ft. Whitcomb-Blaisdell.
24 x 24 x 6 ft. Powell.
30 x 30 x 8 ft. Cleveland Open Side.
36 x 36 x 12 ft. Gray, motor drive.

SCREW MACHINES

No. 4 W. & S. Type G.F.H., 1½ in.
No. 22 Monitor Turret.
21 in. Gisholt.
12 in. Garvin G.F.H.
No. 2 Smith Plain Head.

BORING MILLS

No. 1 Beaman & Smith Horizontal.
No. 1 Cleveland Horizontal.
54 in. Bullard Rapid Production Type.

MILLING MACHINES

Becker Heavy Hand.
No. 0 Bristol Hand.
No. 1 Standard Vertical Spline.
No. 3 Bristol Vertical.
No. 2 Pratt & Whitney Plain.
No. 1 Garvin Universal.
No. ½ Van Norman Duplex.
No. 4 Hendey Type.
No. 3 Thurston Die.

LATHES

13 x 6 Worcester.
16 x 6 Flather.
18 x 8 Rahn Larmon.
19 x 14 Sidney Heavy Duty.
23 x 15 Porter.
25 x 14 Sidney Heavy Duty.

DRILLS

3-spindle Reed-Prentice.
4-spindle Allen.
4-spindle Rockford.
6-spindle Taylor & Fenn.
1-spindle Allen.
26 in. Hoefer.
28 in. Hoefer.
3 ft. Taylor & Fenn Radial.
4 ft. Fosdick Radial.

SHAPERS

14 in. Flather.
15 in. Kelly.
16 in. Sellew.
18 in. Springfield.

WOODWORKING MACHINERY

Dover V & H Boring Machine.
Field Swing Saw, 6 ft. arm.
Tannewitz Saw Bench, motor driven.
16 in. Crescent Jointer.
36 in. Sidney Band Saw.
10 in. Woods 4-sided Inside Moulder.

MISCELLANEOUS

11 in. Gleason Gear Generators.
No. 612 Fellows Gear Shapers.
No. 15 Whiton Automatic Gear Cutter.
Whiton Hand Feed Gear Cutter.
No. 2 Standard Swaging Machine.
No. 4 Dayton Swaging Machine.
No. 4-B Cochrane & Bly Cold Saws.
No. 2-B Cochrane & Bly Cold Saws.
No. 11 Higley Cold Saw.
20 in. Burke Cold Saw.
Gould & Eberhardt Rack Cutter.

BROWNELL MACHINERY CO.

PROVIDENCE, R. I.

New MACHINE TOOLS Used
READY TO SHIP

AUTOMATICS

3—No. 19 Brown & Sharpe (NEW)
5—No. 00 Brown & Sharpe (NEW)
2—No. 0 Brown & Sharpe (NEW)
2—No. 2 Brown & Sharpe.
1—No. 2-G Brown & Sharpe.
1—¾-½-in. Cleveland Model "A".
4—⅝-in. Cleveland Model "A".
6—⅝-⅞-in. Cleveland Model "A"
—⅞-in. Cleveland Model "A".
1—1¼-in. Cleveland Model "A".
3—2¼-2½-in. Cleveland Model "A".
3—2¼-2¾-in. Cleveland Model "A".
1—2¾-3¼-in. Cleveland Model "A".
1—3¼-3½-in. Cleveland Model "A".
5—2⅝ in. Gridley 4 Spindle.
2—No. 72 National Acme plain.
1—1 in. Radical 4 spindle.
5—No. 6-A Potter & Johnson.

TURRET LATHES AND HAND SCREW MACHINES

1—No. 0 Brown & Sharpe, semi-automatic.
20—No. 1 Warner & Swasey, plain head, bar capacity ⅝ in. (NEW).
7—No. 2 Warner & Swasey, plain head, bar capacity 1 in. (NEW).
1—No. 1 Millholland, plain head, bar capacity 1 in. (NEW).
15—No. 3 Stecher Superior, plain head, bar capacity 1 5/16 in.
5—No. 4 Warner & Swasey, geared friction head, bar capacity 1 ⅛ in. (NEW).
1—No. 4 Millholland geared friction head, power feed to turret, bar capacity 1 ⅛ in. (NEW).
1—No. 6 Biggs, geared friction head, power feed to turret, bar capacity 2 in.
2—No. 2-A Warner & Swasey, hollow hex.

DRILLS

2—National-Acme 6-spindle horizontal.
10—Detroit 5-spindle horizontal.
1—23-in. Snyder Sta. Head.
75—Sigourney Sensitive, ⅝-in. capacity.
90—Filton Sensitive, ⅝-in. capacity.
1—Demco 2-spindle Pedestal, ⅝-in. capacity.
2—Demco High Speed Bench, ⅝-in. capacity.
4—Leland-Gifford 12-in., high-speed bench, capacity ¾ in. (NEW).
2—Leland-Gifford, 12-in. high-speed, 2-spindle Pedestal, ¾-in. capacity.
8—Leland-Gifford 14-in. High-Speed Pedestal, capacity ⅜ in. (NEW).
1—Leland-Gifford 14-in., 2-spindle power feed, tapping attachment.
8—No. 23 Henry & Wright 12-in., 2-spindle, capacity ⅝ in. (NEW).
4—No. 35 Henry & Wright 12 in., 3-spindle, capacity ⅝ in. (NEW).
10—No. 47 Henry & Wright 1 -in., 4-spindle, capacity ⅝ in. (NEW).
3—24-in. Barnes, R.G.
1—24-in. Defiance high duty.

LATHES

1—6 x 20-in. Dalton Bench.
3—7 x 32-in. Elgin Bench.
2—8 x 36-in. Rivett Bench.
3—12-in. x 5-ft. Pratt & Whitney Tool Room.
1—12-in. x 5-ft. Davis.
1—14-in. x 6-ft. Hendey Tool Room.
1—14-in. x 6-ft. Fitchburg.
1—14-in. x 5-ft. Mulliner Tool Room, taper attachment, draw-in. attachment, collets, pan and pump.
1—16-in. x 6-ft. R. & LeBlond.
1—16-in. x 8-ft. Hendey Tool Room.
1—16-in. x 8-ft. Hamilton Lathe, Q.C.G.
1—18-in. x 10-ft. Hendey.

SHAPERS

1—16-in. Hendey Crank (NEW).
1—16-in. Gould & Eberhardt Crank (NEW).
1—20-in. Gould & Eberhardt Crank (NEW).
1—20-in. Cincinnati Crank (NEW).
1—24-in. Cincinnati Crank (NEW).

GEAR CUTTERS

5—No. 3 Barber-Colman Hobbers.
5—No. 12 Barber-Colman Hobbers.
2—16-in. Cincinnati Hobbers.

GRINDERS

6—No. 1 Brown & Sharpe Universal (NEW).
1—No. 2 Brown & Sharpe Universal (NEW).
1—No. 2 Oakley Universal.
1—Woods Universal Cutter & Reamer Grinder.
1—No. 1 Grand Rapids Tool and Cutter.
1—No. 120 Gardner Disc.
1—Gisholt Tool.
2—Ott 5 x 18-in. Plain Cylindrical with automatic feeds.
1—No. 2 Wilmarth & Morman Surface.
3—No. 2 Blair Surface.
1—No. 2 Brown & Sharpe Surface.

MILLING MACHINES

2—No. 2 Rockford Universal (NEW).
1—No. 2 Cincinnati Universal, cone type with vertical head (NEW).
1—No. 2½ Rockford High Power Universal (NEW).
1—No. 3 Van Norman Duplex Milling Machine.
1—No. 2 Kempsmith Plain (NEW).
1—Briggs, Type "A", 16-in. Traverse.
6—No. 0 Burke, bench.
3—Carter-Hakes, bench.
6—No. 3 Burke.
10—No. 1 Toledo (Kent-Owens).
10—Wisconsin.
5—No. 1 Standard.

MISCELLANEOUS

1—No. 1 J. N. Lapointe Broaching Machine.
1—No. 2 J. N. Lapointe double Broaching Machine.
2—⅝-in. Rickert Shafer Tapping Machines.
1—No. 1 Baird Tumbling Barrel, double oblique, 22-in. steel barrel.
1—Racine high-speed Saw, 6 x 6-in.
2—Peerless High Speed Saws, 6 x 6-in.

BARBOUR, LOVE & WOODWARD, Inc.

SINGER BUILDING — Phone Cortlandt 133 — NEW YORK CITY

1921 PRICES—1921 PRICES

We have reduced prices on our entire stock of over 400 machines to meet 1921 conditions

BORING MILLS

12 ft. Betts modern, motor driven.
100 in. Betts, 3 heads, like new.
76 in. Betts, heavy, modern.
60 in. Niles-Bement-Pond, heavy, single pulley drive.
60 in. Bickford, standard, 2 heads, low price.
48 in. Colburn, 2 heads, modern.
36 in. Bullard, vertical turret.
8—24 in. Bullard, turret type.
3½ in. Horiz. Universal, belt driven.
4 in. Espen-Lucas Horiz. floor type.
3 in. Betts, horiz., knee type.

DRILLS

8 ft. Niles Plain Radial.
6 ft. Baush Plain Radial, like new.
6 ft. Bickford semi-univ. Radial.
5 ft. Niles-Bement-Pond, motor driven.
4 ft. Gang, gear box drive.

LATHES

60 in. x 20 ft. Fifield D.C. Motor Drive.
52 in. x 22 ft. New Haven triple geared, pulley drive.
60 in. x 17 ft. New Haven Pulley.
36 in. x 14 ft. Putnam triple geared.
36 in. x 12 ft. Pond triple geared.
30 in. x 12 ft. Johnson.
28 in. x 18 ft. Johnson.
20 in. x 8 ft. and 10 ft. Americans.
20 in. x 8 ft. Lodge & Shipleys.
14 in. x 6 ft. Mulliner tool room.
14 in. x 6 ft. Monarch.
12 in. x 5 ft. P. & W.
10 in. x 4 ft. Seneca Falls.

MILLING MACHINES

8—No. 5C Becker Verticals, new, price right.
No. 3 Le Blond, plain, high duty.
No. 5 Becker-Brainard Plain.
No. 2 Kempsmith Universal.
50 in. x 8 ft. Ingersoll Slab.
No. 25 Becker Plain.

PLANERS

84 in. x 84 in. x 13 ft. Sellers, 3 heads, belt driven.
48 in. x 48 in. x 14 ft. Powell, 4 heads, reversible motor drive, complete with electrical equipment.
48 in. x 48 in. x 16 ft. Bement-Miles, 4 heads, belt driven.
42 in. x 42 in. x 12 ft. Pond Machine Tool Co., 2 heads, belt driven.
36 in. x 36 in. x 12 ft. Niles-Bement-Pond, 3 heads.
30 in. x 30 in. x 10 ft. Flather, 2 heads, belt driven.
30 in. x 30 in. x 6 ft. Gray, 2 heads, parallel drive.

SHAPERS

2—16 in. Newark, box table and vise.
4—15 in. Hendy, box table and vise.
—15 in. Smith & Mills, box table and vise.
3—48 in. Morton, extra heavy draw cut.

MISCELLANEOUS

Whiting Punch and Shear, 1 in. cap.
10 ft. Bement Boiler Plate Rolls.
18 in. Betts heavy type slotter.
8 in. New Haven slotter.
Single and Double Action Presses.

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IT MIGHT BE HERE!

Seneca Falls (Star) 13 in. x 6 ft. Engine Lathe, with compound rest, 7½ in. 3-jaw Universal and 10 in. 4-jaw Independent chucks, fitted.

Stark No. 4 Precision Bench Lathe, 9-in. swing, compound slide rest, chasing attachment, 3-speed wall countershaft and 5 in. 3-jaw Whiton chuck, fitted.

Cincinnati No. 2 Universal Grinding Machine, capacity 12 in. x 36 in., with water supply, pump and piping, and Heald Magnetic Chuck.

Whitcomb 22 in. x 22 in. x 6 ft. Planer, second belt drive.

Niles 60-in. Vertical Boring and Turning Mill, with two swivel heads.

Perkins No. 5 Power Press, 1½-in. stroke.

These tools have been used—but not abused—we won't invest our money in any but the better-than-the-best kind—which you will find—so keep us in mind.

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Located at Our Various Factories and Stores

LATHES

18 in. x 8 ft. LeBlond, quick change.
22 in. x 8 ft.
24 in. x 10 ft. Whitcomb, q.c.
26 in. x 10 ft. Pond, Q.C., 220 v., D.C., Motor.
26 in. x 26 ft. Niles, C.R.
28 in. x 12 ft. Pond, c.r.
28 in. x 18 ft. Niles, c.r.
32 in. x 12 ft. Pond, c.r.
36 in. x 20 ft. Pond, 220 v, D.C. Motor.
42 in. x 20 ft. Niles c.r.
48 in. x 30 ft. Niles c.r.
50 in. x 17 ft. F.B. Miles.
50 in. Niles Pulley Lathe.

MILLERS AND GEAR CUTTERS

No. 5 B. & S. Plain, cone type.
No. 5 B. & S. Vertical cone type.
No. 3 36 in. x 8 in. B. & S. gear cutter.
No. 4 36 in. x 9 in. B. & S. gear cutter.
No. 6 60 in. x 12 in. B. & S. gear cutter.
15 in. Gleason, bevel gear generator.
6 in. x 48 in. Thread Miller, P. & W. old style.
6 in. x 80 in. Thread Miller, P. & W. old style.

TURRET LATHES

No. 6A Potter & Johnson Auto. 220 v. Motor D.C.
1 in. x 10 in. P. & W. Turret Lathe
2 in. x 24 in. J. & L. cone head.
2 in. x 26 in. P. & W., turret lathe.
2½ in. x 26 in. P & W turn table turret.
28 in. size J. Gisholt, 3¼ in. spindle
24 in. size I. Gisholt, 220 volt, motor drive, d.c.
28 in. Milwaukee rigid, 4⅛ in. spindle.
34 in. size K Gisholt.
32 in. Conradson Turret.

PLANERS

30 in. x 30 in. x 6 ft. Pond, 2 heads.
30 in. x 30 in. x 12 ft. Pond, 2 heads, 220 v. d.c. Reversing Motor Drive.
36 in. x 36 in. x 16 ft. Pond, heavy, 2 hd., 220 v., D.C., Rev. Motor.
38 in. x 38 in. x 10 ft. Niles, 2 heads.
38 in. x 38 in. x 12 ft. Niles, 4 heads.
38 in. x 38 in. x 16 ft. Niles, 3 heads.
42 in. x 42 in. x 14 ft. Pond, 3 heads.
60 in. x 60 in. x 14 ft. Niles, 4 heads.
60 in. x 60 in. x 20 ft. Niles, 3 heads.
60 in. x 60 in. x 24 ft. Niles, 4 heads.
72 in. x 72 in. x 20 ft. Ridgway, 4 heads, 220 v. Rev. Motor, d.c.

DRILLING MACHINES

40 in. Aurora, Tap. attach.
3 ft. Grant radial drill and boring mach.
4 ft. Niles full universal, old style, 220 v. Motor d.c.
6 ft. Niles Semi univ., 220 v., motor d.c.
6 ft. Niles semi-universal, old style.
6 ft. Pond Radial 220 v., Motor d.c.
6 ft. Ridgway, 220 v., D.C. Motor.
No. 13 P. & W. Multi, 12 spindles.

GRINDERS

2¼ in. Drill Grinder.
No. 8 Higley Saw Grinder.
8 in. x 30 in. Fraser Univ.
10 in. x 72 in. Plain Norton.

BORING MACHINES

No. 1 Bement Horiz. 2⅞ in. spindle, 5 ft. table.
No. 2 Bement Horiz. 3⅞ in. spindle, 6 ft. table.
No. 3 Bement Horiz. 4⅝ in. spindle, 9 ft. table.
No. 4 Bement Horiz. 4⅝ in. spindle, 10 ft. table.
60 in. Bement Bor. & T. Mill.
10 ft. Niles B. & T. Mill, 220 v. Motor d.c.
5 in. Spindle Niles Floor Borer.
6 in. Spindle Bement Floor Bor. and Drill. Mach.

MISCELLANEOUS

Air Compressor, type 10, Ingersoll-Rand steam driven, capacity 535 ft.
Air Compressor, Ingersoll-Rand duplex, motor driven, with 35 hp. d.c. motor capacity 215 ft.
Air Compressor, Gardner, Class D, Duplex, Steam, Capacity 837 ft.
Blower No. 10 Sturtevant.
Blower No. 70 Buffalo.
Crane, 20 ton, 48 ft. span, Sellers, 220 v. motor d.c.
Engine 125 hp. Phila. Cross Compound Corliss Air Conn.
Engine 200 hp. Phila Corliss.
Engine 250 hp. Phila. Corliss Twin.
Engine, Generator Set, d.c. 220 v., 100 kw.
Keyseater, No. 1 Baker.
Motor Mill type, 100 hp. West, 220 v, 2 p. 60 c. a.c.
Profiler No. 3 Automatic, Keller.
Saw 8 in. rounds, Higley.
Separator, American No. 1 Oil.
Slotter, 6 in. Bement.

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PRODUCTION MILLERS

3—12-in. BRIGGS type "B" all NEW.
2—16-in. BRIGGS, type "A," like new.
4—18-in. CINCINNATI Automatic Plain, very latest, like new.
2—No. 5 HENDEY, Lincoln type, latest.
18—BECKER No. 7-H, Lincoln type, very latest type, good as new, and complete.
6—P. & W. 12 in. Heavy Automatics. New.
2—KEMPSMITH No. 32 Lincoln type.
14—P. & W. 12 in. Light Automatics, Semi-Auto.

MILLING MACHINES

2—No. 3-A BROWN & SHARPE Universal S.P.D.
2—No. 2 KEMPSMITH Plain, 95% new.
1—No. 3 BECKER Vertical, rotary table.
10—No. 3½ FOX Plain, latest type.
6—No. 25 BECKER, B.G., plain.
1—No. 3 BROWN & SHARPE Vertical.
1—No. 1 BROWN & SHARPE Vertical. Brand NEW.

POWER PRESSES

1—No. 406-A ADRIANCE Geared Arch type, latest, 30½ in. between housings.
3—No. 18 EXCELSIOR Inclinable, same as 18 Bliss, weight 750 lb., 1½-in. stroke, all new, guaranteed.
8—No. 10 EXCELSIOR, foot, new.
1—No. 1-A STILES Horning Type. Adjustable Bed, 5800 lb. weight.
1—No. 5-C MANVILLE, straight-sided.
1—No. 3 Z. & H. 900 lbs. Inclinable.
1—No. 01—V. & O.—800 lb. Inclin. 2 in st.

HIGH-SPEED DRILL PRESSES

9—HENRY & WRIGHT, 3, 4, 5 and 6-spindle, very latest type, oil pumps, all like new.
12—ALLEN, 5 and 6-spindle, very latest type, complete, all good as new.
1—ALLEN 4 spindle, latest.
5—20-in. EXCELSIOR, B.G., power feed, auto. stop, upright, all BRAND NEW.
8—20-in. BUFFALO, B.G., upright power feed, auto. stop, all BRAND NEW.
3—14-in. EXCELSIOR, sensitive, ½-in. cap.
3—LELAND-GIFFORD, 3-spindle, latest.
4—ALLEN, 2-spindle, very latest.
1—36-in. AURORA, B.G., tapping attachment.
1—28-in. AURORA, B.G., tapping attachment.

SCREW MACHINES

1—No. 4 FOSTER, geared, friction head, very late type, 1⅝-in. capacity.
1—No. 3-A WARNER & SWASEY hollow hex. Universal Turret Lathe, very latest type.
3—No. 6 WARNER & SWASEY, geared, head friction, latest type, p.f. to t., like new.
3—2¼-in. GRIDLEY 1-spindle automatics.
5—WOOD 1¼-in. model C, tilted turret.
1—No. 2 WARNER & SWASEY, plain head.
15—No. 2 FOSTER, hand, like new.
20—No. 1 FOSTER, hand, like new.
15—No. 1 and 2 PRATT & WHITNEY, very latest, hardly used at all.

SHAPERS, ETC.

1—24-in. SMITH & MILLS, BRAND NEW.
1—20-in. MILWAUKEE, B.G., BRAND NEW.
1—14-in. GOULD & EBERHARDT, B.G.
1—16-in. STOCKBRIDGE, B.G., latest.
1—15-in. POTTER & JOHNSON, univ. table.

TOOL ROOM AND PRECISION LATHES

2—16-in. x 7 ft. HENDEY very latest type with taper, etc.
1—12-in. x 6-ft. HENDEY very latest type.
2—No. 608 RIVETT screw cutting precision, very late type with collets, etc.
7—7-in. x 32-in. PRATT & WHITNEY, very latest.
2—No. 606 RIVETT Chasing Bar with collets.
5—HJORTH precision, complete new.

GOOD LATHES ONLY

2—20-in. x 10-ft. REED-PRENTICE, taper attachments, with full swing of 22 in.
2—20-in. x 10-ft. HAMILTON, taper attach., D.B.G., 3 step cone, with 22 in. full swing.
1—18-in. x 10-ft. LEHMANN, Q.C.G. taper attach., D.B.G., 3 step, with 20 in. full swing.
2—16-in. x 10-ft. WHITCOMB-BLAISDELL, Q.C.G., full 18 in. swing, taper and turret attach. if wanted.
1—18-in. x 8-ft. REED-PRENTICE Q.C.G., full 20 in. swing.
1—18-in. x 8-ft. PRENTICE BROS. Geared Head, taper attach. chuck etc.
1—18-in. x 8-ft. REED-PRENTICE full 20-in. swing. BRAND NEW.
1—16-in. x 8-ft. GREAVES-KLUSMAN D.B.G. pan bed.
1—16-in. x 8-ft. MONARCH Q.C.G., D.B.G.
2—11-in. x 5-ft. SENECA FALLS, very latest type with chucks.
2—12-in. x 5-ft. REED, brand new.

HEAVY LATHES

1—36-in. x 14-ft. PUTNAM, triple geared, with taper attachment, latest type.
1—24-in. x 8-ft. LODGE & SHIPLEY, Q.C.G., taper attachment and chuck.

MISCELLANEOUS

2—FOX MONITOR LATHES, American, like new, 18-in. x 6-ft. Friction head, D.B.G.
1—SLOTTER, Wm. Pilton, latest.
1—Riveter, Schuster, ⅜-in. "Elastic Rotary" blow.
1—SHEAR-BETHLEHEM, No. 2, rotary.
1—No. 3 P. & W. vertical surface grinder.
1—SURFACE GRINDER, No. 2 type, mag. ck.
1—Rotary Shear—Quickwork New.
1—Keyseater—Davis No. 2—Like New.

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USED MACHINERY

LATHES

1—10 x 5 **Pratt & Whitney** Tool Room Lathe, elevating rest, taper attachment, oil pan, etc.
6—14 x 6 **Monarch Lathes,** 3 step cone, double back geared, quick change gear, compound rest.
2—14 x 6 **Pratt & Whitney** Tool Room Lathes, compound elevating rest (actual swing 16 in.).
1—14 x 6 **Pratt & Whitney** Tool Room Lathe, compound elevating rest, taper attachment.
1—14 x 8 **American Lathe,** quick change gear, compound rest, taper attachment.
1—16 x 6 **Monarch Lathe,** with pan and pump.
1—16 x 6 **Monarch** Lathe, quick change gear, compound rest, taper attachment.
1—18 x 6 **Monarch** Lathe, 3 step cone, double back geared, quick change gear, compound rest.
1—18 x 8 **Hendey** Lathe.
1—18 x 10½ **Boye & Emmes** Lathe.
1—24 x 12 **Boye & Emmes** Lathe.
1—25 in. x 24 in. bed, **LeBlond** Heavy Duty **Lathe.**

TURRET MACHINERY

1—No. 2 **Pratt & Whitney** Hand Screw Machine.
1—No. 4 **Kent-Owens** Screw Machine, geared friction head, automatic chuck, oil pan, etc.
1—3 x 36 **J & L** Chucking.
1—21 in. **Gisholt** Turret Lathe.
3—Model "B" 2 in. **Cleveland** Automatics.
8—3⅝ Model "A" No. 2 Spindle Drive **Cleveland** Automatics.

MILLING MACHINES

1—No. 0 19 x 6 x 15 **Brown & Sharpe** Plain Milling Machine.
1—1-B **Milwaukee** Plain Milling Machine.
1—1-B **Milwaukee** Universal Milling Machine.
1—No. 2 28 x 10 x 19 **Brown & Sharpe** Vertical Spindle Milling Machine.
6—**Pratt & Whitney** Automatic Milling Machines.

HORIZONTAL BORING MACHINES

1—2½ in. Bar **Cleveland** Horizontal, direct connected 220 volt, D.C.
1—No. 4 **Niles** Horizontal Boring and Drilling Machine 6 in. bar.

DRILLS

1—14 in. **Leland-Bifford** Ball Bearing Sensitive Drill.
1—16 in. **Leland-Gifford** Round Column, sliding head, high speed, ball bearing sensitive drill.
1—2½ ft. **Mueller** Plain Radial.
1—48 in. **Fosdick** Box Column Radial Drill.
1—5 ft. Universal Radial.

GRINDERS

1—6 x 20 No. 203 **Fitchburg** Grinder.
1—No. 1 **Landis** Universal.
1—No. 3 **Landis** Universal.
6—No. 22 **New Heald** Surface Grinders.
1—16 in. **Heald** Rotary, with Magnetic Chuck and Generator.
1—No. 3 **Van Norman** Internal.
1—**Bryant** Internal with chuck, Draw-In Collet Adaptor and six extra spindles.

PLANERS AND SHAPERS

1—24 in. **Cincinnati** Planer widened to 34 in., 8 ft. Table, one head on rail.
1—30 x 30 x 10 ft. **Gray Planer,** two heads, spiral drive.
1—36 x 36 x 12 ft. **Gray** Planer with 2 heads, 220 volt, D.C. motor drive.
1—56 in. x 56 in. x 16 ft. **Gray** Planer, three heads and auxiliary head, motor drive, D.C.
1—24 in. **Milwaukee** Back Geared Crank Shaper.

MISCELLANEOUS

5—No. 3 **Lees-Bradner** Thread Milling Machines.
2—**Taft-Peirce** Thread Milling Machines.
1—10 ft. **Ryerson** Bending Roll, Cap. ¾ Plate, direct connected, 220 volt, D.C. motor.
1—No. 301-D Ferracute Press (good as new).
1—6 ft. **Lennox** Rotary Shear, ¾ Plate, arranged for motor drive.
1—⅝ **Shuster** Rotary Riveter.
1—4 in. **Cochrane & Bly** Cold Cut-Off Saw.
1—**Cochrane & Bly** Saw Sharpener.
1—20 x 8 **Oliver** Wood Turning Lathe.
1—No. 4 **Hilles & Jones** Double End Punch and Shear, 36 in. throat arranged for motor drive.
1—12 in. Throat **Cleveland** Punch.

THE HESS-SCHENCK CO., Cleveland, Ohio

ESTABLISHED 1876

FRANK TOOMEY Inc.

ESTABLISHED 1876

127-131 N. THIRD ST. PHILADELPHIA, PA.

MACHINE TOOLS

LATHES

No. 2 Ideal Precision Lathe.
11-in. x 5-ft. Hudson, C.R., H.S.
13-in. x 5-ft. 6-in.—7-ft. 6-in. Carroll-Jamieson.
14 in. x 6 ft.—8 ft. Sidney, D. B. G., Q. C.
15 in. x 5 ft.—8 ft. Sidney, D. B. G., Q. C.
15 in. x 6 ft.—8 ft.—12 ft. Carroll-Jamieson, Q. C.
15 in. x 6 ft. Southbend, C. R., H. S.
15 in. x 8 ft. Rockford, S. Q. C.
16 in. x 7 ft. Willard, D. B. G., S. Q. C.
16 in. x 8 ft. Monarch, D. B. G., Q. C.
17 in x 8 ft.—10 ft.—12 ft. Sidney, D. B. G., Q. C.
18 in. x 8 ft. Flather, C. R.
18 in. x 10 ft. Carroll, D. B. G., Q. C. G.
19 in. x 8 ft.—10 ft.—12 ft. Sidney, D. B. G., Q. C.
20 in. x 8 ft. Whitcomb-Blaisdell.
24 in. x 10 ft. Schumacker-Boye, C. R.
25 in. x 14 ft. Sidney, D. B. G., Q. C.
26 in. x 24 ft. New Haven.
36 in. x 16 ft. Sidney, D. B. G., Q. C. G.
42 in. Pond Car Wheel Lathe, Motor Drive.
21 in. Gisholt turret.
No. 1 Bardon & Oliver Screw Machine
No. 6 Bardon & Oliver Turret.

MILLERS

No. 1 Dow, Plain, New.
No. 2 Garvin M. U. New.
No. 2 Garvin A. New.
No. 3 Burke, Hand, New.
No. 4 Brown & Sharpe, Plain, Used.
No. 22 Garvin, Vertical.
No. 24 Osterlein, Plain, Used, Vert. Hd.
No. 0 Steptoe.

KEYSEATERS

1—No. 2 Catlin
2—No. 4 Catlin
1—No. 0 Baker

PLANERS

48 in. x 48 in. x 16 ft. Pond, 4 Hds.
48 in. x 48 in. x 10 ft. Cleveland, Open Side, 2 Hds.
36 in. x 36 in. x 12 ft. Fitchburg, 1 Hd.
36 in. x 36 in. x 10 ft. Cincinnati, 3 Hds.
36 in. x 36 in. x 8 ft. Gray, 2 Hds.
24 in. x 24 in. x 6 ft. Pease, 1 Hd.
16 in. x 16 in. x 42 in. Walter, 1 Hd.

PRESSES AND SHEARS

No. 10 Excelsior Foot Press
No. 121-126-134A Max Ams
No. 41 Beloit Splitting Shear.
No. 46-46½-47 Alligator Shear
No. 52-53-54-55 Beloit Combined Punch and Shear.

PIPE MACHINES

2 in.-4 in.-6 in. Oster, New.
8 ft. Lowe "Victor"
No. 736 Greenfield, Bolt Threader, Cap. 1¼—1½ in.
No. 734 Greenfield, Bolt Threader, Cap. ½ to 2 in.

SHAPERS

7 in. Rhodes Precision
14 in. Steptoe
16 in. Steptoe, B. G. Motor Drive
16 in., 20 in., 24 in. Steptoe, B. G.
16 in. Hendey, Used.

SLOTTERS

10 in. Stevens Belt Drive.
10—12 in. Dill, Belt Drive
16 in. Betts, Belt Drive
18 in. Newton, Motor Drive

BORING MILLS

42 in. Bullard V. 2 Hds. Used.
3 in. Bar Horizontal Binsse.

DRILL PRESSES

3 ft. Mueller, Plain, Cone, Radial
48 in. Mueller, gear box, single pulley, Radial.
4 Spindle Superior, High Speed.
10 in. Burke Sensitive Bench
10 in. Buffalo Sensitive Bench
11 in. Excelsior Sensitive Floor.
16 in. Canedy-Otto Plain
20 in. Buffalo, B. G., P. F.
20 in. Champion, B. G., P. F.
21 in. Superior, S. H. Bronze, Bushed, Hi-Speed.
25 in. Buffalo Stationary Head.
28 in. Superior Sitting Head
28 in. Snyder, B. G., P. F., S. H.
42 in. Canedy-Otto Post

MISCELLANEOUS

No. 1 Fraser Grinder
No. 1 Grand Rapids Universal Grinder
½ in. to 1½ in. Spindle, Double End, Grinder.
10 in. x 36 in. Norton, Plain Grinder.
No. 190 Wells Universal Grinder.
No. 1 Myers Power Saw.
5 in.-6 in.-7 in. North Wales Power Saw.
6 x 6—9 x 9 Peerless Power Saw.
25—50—100 lb. Little Giant Power Hammer
40 x 6¼ Bement Auto Spur

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MACHINERY IN STOCK

FOR IMMEDIATE DELIVERY

BORING MILLS

3 in. Rockford Horizontal Boring Mill.
7 ft. Vertical Boring and Turning Mill, $2,500.
12 ft. Vertical Boring and Turning Mill, 2 heads on the rail, first-class condition, $5,000 before removal.

AIR COMPRESSORS

Bury Air Compressor 10 x 6.
Laidlaw-Dunn Gordon Air Compressor, 16 x 9½ x 8, 100 lb. pressure.
Bury Steam Driven Air Compressor, 10 x 16 x 10 x 10, 340 ft., 100 lb. pressure, steam driven.

RADIAL DRILLS

4 ft. American Radial Drill, extra heavy type, single pulley, gear box drive, $1,000.
5 ft. Prentice Radial Drill, tapping attachment, $1,000.
5 ft. Forsythe Radial Drill. $600.

STEEL

5/16 Cold Rolled Steel 4½c a lb. in 12 ft. bars.
Tubing ¼ in. 10c a lb.

SCREW MACHINES

¾ in. Acme, 4-spindle Screw Machine.
2¼ in. Gridley Automatic Screw Machine, motor driven with cams.
Foster Screw Machine.
No. 2 S. P. Garvin Screw Machine.
Bardon & Oliver No. 4 Screw Machine, back geared, friction head.
Warner & Swasey No. 4 Screw Machine, back geared, friction head.

PLANERS

18 x 18 x 2 ft., $150.00.
30 x 30 x 12 ft., $600.00.
42 x 42 x 12 ft., 3 Head Planer, $2,500.00.

DRILL PRESSES

8 Brand New 20 in. back geared, power feed, belt driven Drill Presses, Silver or Fairbanks; $165 ea.
25 in. Snyder, back geared, power feed, belt driven, sliding head; $200.
Also 1, 2 and 3-spindle Drills in stock at low price.

GEAR CUTTERS

Brown & Sharpe Gear Cutter 24 in.
Gould & Eberhardt Gear Cutter 24 in.

GRINDERS

Yankee Twist Drill Grinder.
No. 11 Brown & Sharpe Cylindrical Grinder.
No. 3 Brown & Sharpe Universal Tool and Reamer Grinder.
Norton Cylindrical Grinder 10 in. x 50-in. $750.

ENGINE LATHES

50 Engine Lathes, various sizes, various makes from $100 up.

POWER PRESSES

Consolidated No. 2½, 2 in. stroke.
2 Mossberg's 1 in. stroke.
No. 103 V & O with dial feed, 6 in. stroke.
Zeh & Hahnemann, Dinkin.

SHAPERS

16 in., 20 in., 24 in. Hendey Shapers.
20 in. Gould & Eberhardt Back Geared Shaper.

Always in the market to buy good used machinery

B. FREIDUS & COMPANY, 453 Atlantic Avenue, Cor. Oliver St., Boston, Mass.

PARTIAL LIST OF OUR STOCK

PRESSES
1—No. 59¼ Toledo, double geared, straight column, stroke 8 in.; weight approx. 70,000 lbs.
2—No. 59 Toledo, double geared, straight column, stroke 12 in.; weight, each, approx. 50,000 lbs.
2—No. 58 Toledo, double geared, straight column, stroke 14 in.; weight, each, approx. 33,000 lbs.
3—No. 57 Toledo, double geared, straight column, stroke 18 in.; weight, each, approx. 20,000 lbs.
6—No. 857 Toledo geared Rack and Pinion Reducing; weight, each, approx. 22,000 lbs.
1—No. 20 Bliss Inclinable.
1—No. 21 Bliss Inclinable.
35—No. 16 Bliss Horning.
4—No. 42 hp. Toledo Horning—New.
5—No. 39-B Bliss Horning with 12 station dial feed—NEW.
2—No. 19 Bliss Inclinable.
1—No. 14-A Stoll Inclinable.
3—No. 3 Thomas Open Back Inclinable—NEW.
3—No. 4 Thomas Open Back Inclinable—NEW.

PLANERS
3—48 x 48 x 12 Putnam, 2 heads.
1—48 x 48 x 30 Putnam, 4 heads, belt drive.
3—26 x 26 x 10 Putnam, 2 heads, belt drive—NEW.
6—26 x 26 x 8 Putnam, 2 heads, belt drive—NEW.
1—30 x 30 x 8 Powell, 2 heads, belt drive.
1—36 x 36 x 12 Gray, 2 heads, belt drive.
1—24 x 24 x 6 Gray, 1 head, belt drive.

MILLING MACHINES
36—12 in. PRATT & WHITNEY SEMI-AUTOMATIC.
1—No. 3H Milwaukee plain, single pulley drive, with vertical head and slotting attachment.
1—No. 2 LeBlond heavy duty plain.
1—No. 3 Kempsmith plain.
3—No. 2 Brown & Sharpe plain.
40—No. 6 Whitney Hand.
30—Standard Hand Power Feed.
8—No. 10 Pratt & Whitney Hand.
8—No. 0 Bristol Hand.
10—No. 3½ Fox Hand.
6—4 in. Pratt & Whitney spline.
8—2 in. Pratt & Whitney spline.

GEAR CUTTERS
1—48 in. Gould & Eberhardt Spur gear cutter.
1—24 in. S. & S. gear hobber with spiral gear attachment.
2—8 in. Hercules gear hobbers—NEW.

RADIAL DRILLS
1—3 ft. Fosdick, cone drive.
1—5 ft. American gear box drive.
1—6 ft. Baush, cone pulley drive—NEW.

HORIZONTAL BORING MILLS
1—No. 2 Rockford Boring and Drilling Machine, Motor drive, direct current motor.
1—Bement-Niles, 2½ in. bar with rotary table.

DRILLS
1—36 in. Gould & Eberhardt.
1—25 in. Silver, back geared—NEW.
6—Moline Hole Hogs—single spindle 3 in. capacity.
1—34 in. Prentice, back geared.
8—24 in. Baker No. 310 heavy duty single spindle.
3—20 in. Buffalo back geared—NEW.
20—4-spindle Allen high speed ball bearing.
11—5-spindle Allen high speed ball bearing.
15—6-spindle Allen high speed ball bearing.
2—6-spindle 20 in. Barnes equipped with power feed and automatic return.

GRINDERS
1—14 x 8 Queen City plain—self contained—NEW.
1—10 x 96 Norton plain.
6—10 x 36 Norton plain—ceiling drive.
4—6 x 32 Norton plain—ceiling drive.
11—10 x 36 Cincinnati No. 2 plain.
6—10 x 36 Landis plain—self contained.
12—10 x 24 Landis plain—self contained.
1—No. 11 Brown & Sharpe plain.
1—No. 2 Brown & Sharpe Surface with magnetic chuck.
1—No. 1 Brown & Sharpe Universal.
2—Brown & Sharpe type surface with magnetic chuck.
1—No. 1½ Walker surface with magnetic chuck.
20—No. 1 Wilmarth & Morman Surface.
1—Springfield-Brandes Surface, capacity 12 x 12 x 48.
12—NO. 20 BRYANT CHUCKING—NEW.
70 No. 1 Blount Bench.
30—Brown & Sharpe Bench Type No. 0.
20—Builders' Bench Type.

AUTOMATICS
8—⅝ in. Cleveland Model "B," serial number 17,000 to 18,000.
2—⅝ in. Cleveland Model "A," serial number 17,000 to 18,000.
8—⅞ in. Cleveland Model "A," serial number 17,000 to 18,000.
2—No. 52 National Acme.
1—No. 54 National Acme.

LATHES
1—36 x 36 ft. LeBlond triple geared, quick change gear, belt driven, screw cutting engine lathe—99% NEW.
4—24 x 12 Boye & Emmes quick change gear.
4—22 x 12 Greaves-Klusman quick change gear.
1—25 x 10 Le Blond quick change gear.
1—24 x 12 Reed-Prentice, geared head.
2—20 x 10 Sidney, quick change gear—NEW.
2—18 x 8 Lodge & Shipley quick change gear.
2—18 x 8 Hamilton 3-step cone pulley quick change gear with taper attachment.
3—16 x 8 Sidney, quick change gear—NEW.
12—28 in. Gisholt—NEW.

TURRET LATHES
20—26 in. GISHOLT, 6½ in. HOLE—NEW.
5—2 x 24 in. JONES & LAMSON GEAR FEED WITH BAR EQUIPMENT—NEW.
4—2⅝ x 26 in. Greenlee hollow hexagon.
18—NO. 3-A WARNER & SWASEY UNIVERSAL HOLLOW HEXAGON.
1—3 x 36 Jones & Lamson, geared feed.
1—Steinle.
12—No. 6 Warner & Swasey Screw machines.
40—POTTER & JOHNSTON AUTOMATICS WITH 4 and 5-HOLE TURRETS. STANDARD MACHINES.
6—Wood Tilted Turret Lathes 1½ in. capacity.
5—No. 2-A Warner & Swasey Universal hollow hexagon.
3—No. 0 Foster Screw Machines.
1—No. 12½ Garvin Screw Machine, fully equipped.
6—No. 4 Brown & Sharpe screw machines.

VERTICAL BORING MILLS
1—72 in. Niles, 2 heads on rail, cone pulley drive.
2—42 in. Baush, 2 heads on rail.
1—34 in. King with turret head.

MISCELLANEOUS
4—Model F-3 Kellar Mechanical Engraving machines.
2—No. 0 La Pointe Broaching machines.
4—No. 1 La Pointe Broaching machines.
1—No. 3-B La Pointe Broaching Machine.
1—Norton Crank Shaft Balancing Machine.
1—722 Morgan 800 lb. Steam Hammer.
1—36 in. Steel Brake.
6—No. 12 Pratt & Whitney profiling machine.
1—Ingle Tooth Chamfering machine.
1—6 in. Garvin Cam Cutter.
2—No. 80-B Grant Riveters.
2—Savage Shears, ⅜ in. capacity, 34 in. throat.
1—Rheinecke Relieving Machine.

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1—30 Ton Eight Wheel Orton-Steinbrenner Steam Operated Standard Gauge Locomotive Crane, 52 ft. boom.

PLANERS
84 in. x 84 in. x 25 ft. Sellers, 4 hds., 40 hp. Motor.
60 in. x 60 in. x 20 ft. Woodward-Powell, 4 hds.
48 in. x 48 in. x 28 ft. Cincinnati, 2 hds., New.
48 in. x 48 in. x 20 ft. N-B-Pond, 4 hds., New.
42 in. x 42 in. x 12 ft. Simmons Openside, 2 hds. new.
30 in. x 30 in. x 18 ft. Cincinnati, Medium, 2 hds.

BORING MILLS
34 in. Bertram Vertical, one swivel head.
36 in. Bridgeport Vertical, on swivel head.
Beaman-Smith Horizontal, 3 in. bar.
24 in. Bullard Vertical, with one head.
54 in. Bullard Production Type.
36 in. Bullard New Era Type, complete.

MILLERS
No. 1½ Valley City Plain Miller.
No. 2 Cincinnati Plain Miller.
No. 2 Le Blonde Plain Miller.
No. 3 Hendey Plain Miller.
No. 3 Cincinnati H. Power, Plain.
No. 5 Brown & Sharpe Heavy, Plain.
No. 2 Brown & Sharpe Vertical.
No. 5 Brown & Sharpe Vertical.
Gooley-Edlund H. Duty, Type A and Type B.
No. 25 Becker & Bilton, Plain.

LATHES
84 in. x 26 ft. Putnam Heavy Duty, Motor Drive.
60 in. x 29 ft. 56 ft. N-B-P High Duty, M.D., New.
56 in. x 23 ft. Putnam, Cone Drive, with Taper.
48 in. x 29 ft. 56 ft. N-B-P Heavy Duty, M.D., New.
42 in. x 20 ft. N-B-P, Motor Drive.
36 in. x 34 ft. Bridgeford, All-Geared Head.
36 in. x 14 ft. Putnam H. Duty, Motor Drive.
27 in. x 24 ft. Le Blonde H. Duty, Belt Drive.
27 in. x 18 ft. Le Blonde H. Duty, Motor Drive.
20 in. x 12 ft. Fitchburg, 8 ft. between centers.

RADIAL DRILLS
7 ft. 3 in. Warren Semi-Universal Radial.
6 ft. Reed-Prentice, Plain Tap. Attach.
6 ft. Niles Horizontal, Belt Type.
5 ft. Reed-Prentice, Pl. Belt, G. Feeds.
4 ft. Bickford Plain Radial.
4 ft. American Plain Radial.

MISCELLANEOUS
14 in. x 96 in. Norton Plain Grinder, New.
No. 1 Norton Universal Grinder.
No. 5 Brown & Sharpe Universal Grinder.
32 in. Cincinnati Heavy Duty Shaper.
No. 2-A Warner & Swasey Turret Lathe.
15 in. Hendey Shaper.
16 in. Cincinnati Shaper, Back Geared.
24 in. Hendey Shaper.
10 in. Bement Slotter.
36 in. Fellows Gear Shaper.
No. 1 and No. 4 La Pointe Broaching Mch.

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BORING MACHINES

34 in. Colburn vertical, turret head
38 in. Niles vertical, 2 heads
42 in. Bullard vertical, 2 heads
No. 1—3 in. Lucas horizontal
No. 3A Universal horizontal, table type
No. 2 Beaman & Smith, floor type, 4 in. spindle, motor drive
4 in. Detrick & Harvey, floor type

LATHES

13 in. x 6 ft. Willard, CR, PCF.
14 in. x 6 ft. Porter, Q.C., C.R., P.C.F.
16 in. x 6 ft. Porter, CR, PCF., chuck.
14 in. x 6 ft. Reed, CR, PCF.
16 in. x 8 ft. Flather, QC, CR, PCF.
18 in. x 8 ft. Prentice Br., geared head CR, PCF, oil pan, chuck.
18 in. x 6 ft. Hendey, CR, PCF, taper
20 in. x 20 ft. Reed CR, PCF.
22 in. x 8 ft. Schumacher Boye, CR, PCF.
26 in. x 12 ft. Putnam, CR, DBG, PCF.
38 in. x 20 ft. New Haven, CR, PCF.
36 in. x 12 ft. Fifield, CR, PCF.
56 in. x 24 ft. Wood & Light, BG, CR, PCF.
No. 5 Rivett bench, slide rest
3½ in. x 7 ft. Fitchburg lo-swing

TURRET LATHES

1¾ in. Bardons & Oliver turret, motor
16 in. Acme universal, friction BG
24 in. Steinle, heavy duty, geared head
2 x 24 J. & L. flat turret, bar equip.
3 x 36 J. & L., chuck or bar equip.
3½ in. x 44 in. Cincinnati-Acme flat turret, bar and chuck equip.
24 in. Gisholt, 6 in. hollow spindle
24 x 10 Walter Scott turret, heavy duty
No. 3 Windsor wire feed screw mach.
No. 2½ Garvin screw mach., air chuck
No. 51 National Acme, 4 sp. automatic
No. 4 Bardons & Oliver wire feed
½ in. National Acme, 4 sp. automatic
No. 55 1⅝ in. Nat. Acme, 4 sp. auto.
20 in. x 10 ft. Fay & Scott univ. turret

GRINDERS

3 in. x 18 in. Norton plain cylindrical
6 x 32 Norton plain.
10 in. x 30 in. Landis plain
10 in. x 48 in. B. & S. plain
No. 18—12 x 120 Landis plain.
18 in. x 96 in. Norton plain, self contained motor drive.
No. 3—10 in. x 40 in. Modern univ.
12 in. x 60 in. Landis universal
No. 1 LeBlond univ. cutter grinder
No. 1 Cinn. cutter and tool
No. 6A Bryant internal
No. 60 Heald cylinder
No. 6 Rivett internal
20 in. Taylor & Fenn w..ter tool
No. 11 Rivett oscillating
B & S oscillating, ball race
18 in. Ney disc, 2 tables
10 in. Garrigus rotary surface.
No. 34 Van Norman internal, water att.

DRILLS

No. 1—2 sp. Avey, B.B.
2 spindle Avey high speed, B.B.
3 sp. Henry Wright, BB
20 in. Rockford stat. head, B.G., PF.
20 in. Prentice Br., sliding head, BG, PF,
23 in. Rockford sliding head, tapping att.
24 in. Pratt & Whitney., stat. head, BG, PF.
42 in. Cinn., sliding head, BG, PF, tapping att., compound table.
No. 310 Baker Br., heavy duty
No. 1—4 ft. Bickford plain radial.
4½ in. Dreses, plain radial, tap. att.
No. 12—8 spindle Natco multiple.
No. 22—16 spindle Natco multiple.
6 spindle Hendey, power feed to each spindle
No. 30 12 spindle Bausch multiple.

MILLERS

No. 14 Garvin plain, all feeds
No. 2 Cinn. plain, all feeds
No. 3 Cincinnati plain, cone drive.
No. 4 Cincinnati plain, all feeds.
No. 2A Kempsmith plain, BG.
No. 23 B & S plain
No. 1½ LeBlond univ., motor drive
No. 2 LeBlond univ., BG, vert. att.
No. 3 Cinn., high power vertical.
No. 4 Cinn., high power vertical.
No. 4B Becker vertical, cone drive
No. 6 Whitney hand
36 in. x 10 ft. Newton side slab

MISCELLANEOUS

Broaching machine, No. 4 and No. 5 J. N. Lapointe
Centering Machine, 3 in. 2 sp. P & W
Compressor, 8 x 8 single air
Gear Cutter, 36 in. x 9 in. B & S spur
Planer, 24 x 24 x 6 Flather, one head
Planer, 24 x 26 x 7 Gray, one head
Planer, 30 x 30 x 8 Whitcomb, 1 head.
Planer, 30 x 30 x 8 Pond, 2 heads
Planer, 36 x 36 x 12 Pond, 2 heads.
Planer, 36 x 30 x 14 Cincinnati, 3 heads.
Planer, 36 x 36 x 12 Cincinnati, 4 heads.
Planer, 48 x 48 x 15 Sellers, 3 heads
Planer, 60 x 48 x 14 Gleason, 2 heads.
Saw, No. 10 Racine
Keyseater, No. 2 Giant
Press, No. 72 Ferracute straight sided
Shaper, 15 in. Hendey friction
Shaper, 14 in. Springfield crank
Shaper, 14 in. P & W crank
Shaper, 24 in. Hendey friction, motor drive
Steam Engine, 8 x 10 Ide horizontal.
Swaging Machine, Standard
Tapper nut, 6 sp. ½ in. Acme semi-auto.
Profiler, No. 13 1 sp. P & W.
Punch & Shear, style F Rock River, 10 in. throat cap., 1¾ in. rounds.
Welder, No. 6A National Butt

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15—14-in. x 6-ft. Walcott lathes, NEW, Q C.G. D.B.G.
6—Sebastian type gap, 15 x 23-in. x 6-ft.
2—15-in. Fox lathes.
1—No. 608 Rivett bench screw cutting lathe.
10—LeBlond 19 x 8, Q.C.G., D.B G. Like new.
1—Hendey 24 x 10, Q.C.G., late type with taper attachment.

DRILLS AND GRINDERS

6—New Excelsior, 14-in. sensitive.
6—Buffalo 20-in. B.G. drills, new.
2—3-spindle Reid drills.
2—No. 4 Gardner disc grinders.
No. 1 Norton Universal Grinder—like new.

PRESSES

2—No. 44 Adriance Double Action.
6—Bliss No. 16 horning.
6—No. 1-C Standard bench presses, new.
2—No. 2 Baird Double Action.
14—V & O 101 Presses, 5-in. stroke.
9—V & O 102 Presses, 5-in. stroke, some have dial feed.
3—V & O 103 Presses, 6-in. stroke, some have dial feed.
No. 5 Zeh & Hahneman Press.

SPECIAL

15—BRAND NEW 7/8-in. Greenfield Hand Screw Machines. Complete equipment, $150 each.

SHAPERS

1—15-in. Smith & Mills crank shaper, like new.
1—15-in. American crank shaper, like new.
30-in. Cincinnati triple geared.
1—24-in. Kelly B.G.

MILLERS

No. 5 Brainard, 60-in. table mtr. dr.
1—No. 25 Becker B.G.

MISCELLANEOUS

3—Model G Cleveland Automatic 3/8-in., like new.
2—No. 4 Warner & Swasey F.B.G. turret lathes, like new.
1—Gray No. 1 Metal Cutter, 1/8-in. cap., like new.
3/8-in. Grant Rivet Spinner.

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1—Taylor & Fenn, No. 1, Type D, Bench Drill.
1—Taylor & Fenn, No. 3, Type A, Drill Press, three spindle.
1—Weigel 21-in. Sliding Head Drill, belt driven.
1—Dauber-Kratsch 20-in. Upright Drill.
1—Dauber-Kratsch 3-ft. High Speed Radial.

LATHES

2—Hamilton 20 in. x 10 ft. Style B Lathe, 3 step, DBG. back gear.
2—Rockford 9 in. x 12 in. Geared Head Manufacturing Lathes.
1—Rockford 16 in. x 6 ft. Cone Head High Power Manufacturing Lathe.
1—Rockford 16 in. x 6 ft. Tool Room Lathe.

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1—Beaudry No. 7, 200 lb. Champion Type, belt driven.

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1—Peerless 6 in. x 6 in. Hack Saw.
1—Racine No. 1 Hack Saw.

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1—Schmidt Internal Grinder.
1—Norton No. 2 Universal Tool and Cutter Grinder.
1—Gardner No. 4 Disc Grinder.
1—Gardner No. 14 Disc Grinder.
1—Ott 10 in. x 32 in. Universal Grinder.
1—Taylor & Fenn Bore Grinder.
1—Sterling Universal Tool and Cutter Grinder.
1—Taylor & Fenn 20-in. Wet Tool Grinder.
2—Gardner No. 3 Polishing Lathes.
1—Fitchburg 4 x 20 Grinder.

MILLING MACHINES

3—Taylor & Fenn Vertical Milling Machines.
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SHAPER

1—Ohio 14 in. plain, cone drive.

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1—Taylor & Fenn.

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STAY-BOLT DRILL (12 spindles).
CRANES, 30 ton, 75 ft. span.
CRANES, 10 ton, 36 ft. span.
Pawling & Harnishfeger Hzntal. DRILLING AND BORING MACHINES.
Harrington Flue Plate DRILLS —6 spindles.
BOLT CUTTERS — (Single and Double Head) 2½ in. to 4 in.
CUTTING OFF MACHINES
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No. O Brown & Sharpe, plain.
No. 2 Kempsmith, plain.
Nos. 3 and 5 Cincinnati, plain.
No. 3 Brown & Sharpe, Univ. dvdg. hd.
No. 3 Brown & Sharpe, vert., motor drive.

LATHES

7—14-in. x 6-ft. Hendey, geared head.
4—14-in. x 6-ft. Hendey, GH (new).
All lathes arranged for motor drive. Some have Relieving and Draw-in attachments, also taper att. Used lathes practically good as new.

SHAPERS

32-in. Cincinnati, crank, back geared.
16-in., 20-in. and 24-in. Kelly (new).

PLANERS

60-in. x 60-in. x 16-ft. Pond, 4 hds., belted.
48-in. x 48-in. x 14-ft. Powell, 4 hds., M. D.
42-in. x 42-in. x 8-ft. Gray, 4 hds., M. D.
36-in. x 36-in. x 10-ft. Cincinnati, M. D., 200 V. D.C.
42-in. x 42-in. x 14-ft. Liberty, 2 hds., belted.

AUTOMATICS

No. OG Brown & Sharpe, with motor.
No. 2 Brown & Sharpe, belted.
No 2 Brown & Sharpe, chasing att.
No. 2G Brown & Sharpe, belted.
No. 2G Brown & Sharpe, with motor.
No. 56 National Acme, 4 spindle.

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MILLING MACHINES

No. 2 Hendey Universal Millers.
No. 2 Becker Universal Millers.
No. 3 Cincinnati Universal Millers.
No. 4 Cincinnati Universal Millers.
No. 4 Brown & Sharpe Universal Millers
No. 5 Brown & Sharpe Universal Millers.
No. 3 Cincinnati Plain Millers.
No. 3 Pratt & Whitney Plain Millers.
No. 4 Hendey Plain Millers, geared head.
No. 5 Brown & Sharpe Plain Millers.
No. 5B Becker Vertical Millers.
No. 4B Becker Vertical Millers.
No. 5 Newton Duplex Miller, 48 x 8 ft.

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1—Reavell Quadruplex Air Compressor	$500
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2—Lees-Bradner Thread Millers, Each	300
1—73½ Bliss Press	500
3—Rahn & Larmon Engine and Turret Lathes 18 in. x 4 ft., each	150
1—Rahn & Larmon Engine and Turret Lathe, 20 in. x 4 ft. x 6 in.	200
1—Rahn & Larmon Engine and Turret Lathe, 22 in. x 6 ft.	250
2—Walcott & Wood Turret and Engine Lathes, 22 in. x 8 ft.	250
1—Davis Turret Lathe	200
2—Davis Boring Lathes	200
1—4 in. Outlet Furnace Blower and Tank	150

Triplex, Duplex and Rotary Pumps suitable for oil, compound and water. 2⅞ Ball Bearing Hangers. Full line of Steel and Wood Pulleys, Air and Sand Blast Tanks.

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50-in. Bullard Vertical **Boring Mills**, 2 hd.
20-in. Champion **Drills**, pl. and b.g.
40-in. New Haven **Drill Press**, b.g.
3 and 6-ft. Prentice Radial **Drills**, tapp. att.
4 ft. Prentice **Radial**, Sgl. Pulley drive.
16-in. American B.G. **Shaper**, M.D.
24-in. **Cincinnati B.G. Shaper**, M.D.
72-in. x 56-in. x 12-ft. Betts **Planer**, 2 hd.
48 in. x 48 in. x 18 ft. Pond **Planer**, 4 hds.
48-in. x 32-ft. N. B. P. Triple Geared **Lathe**
48-in. x 26-ft. Pond Triple Geared **Lathe**
36-in. x 18-ft., 8-in. Niles **Lathe.**
28-in. x 12-ft. Boye & Emmes Lathe, q.c.g.
26-in. x 10-ft. 6-in. Walcott Lathe, q.c.g.
24-in. x 6-ft. Gisholt Tur. Lathe 6¼-in. H.S.
22-in. x 12-ft. Greaves & Klusman **Lathes**,
18-in. x 8-ft. Sidney **Lathes**, q.c.g.
No. 0 Becker **Ver. Miller**, table 60 x 19-in.
No. 2 Brown & Sharpe **Universal Miller.**
No. 2 LeBlond Universal Miller, vert. att.
No. 3 LeBlond **Plain Miller.**
No. 12 Garvin Plain Miller.

MISCELLANEOUS

Steel Building, 60 ft. x 140 ft. encased in brick yellow pine roof.
Roll Lathe, 20 ft. long, suitable for 12 in., 14 in., 16 in. rolls.
National 3 in. Heading, Upsetting and Forging Machine.
Cleveland Straightening Rolls, 84-in. between housings, rolls 10 in. dia.
Landis 1¼-in. **Bolt Cutter.**
Reade 50-in. throat S. E. **Punch and Shear**
Doelger-Kirsten **No. 4 Alligator Shear.**
Long & Alstatter **Shear** cap. 8 x 1¼ in.
L. & A. No. 2 Twin Punch & Shear.
2500 lb. Bement Miles **Steam Hammer.**
Bliss **No. 76½ S S Press**, 8 in. stroke.
Garrison Dbl. **Crank Press**, 250-Ton Cap.
Bliss No. 18 Inc. **Power Presses.**
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American **No. 2 Universal Wood Trimmer.**

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4—**D-201 Ferracute Straight Sided Geared Presses**, friction clutch, 25 in. stroke.
2—**DGG-56 Ferracute Straight Sided Geared Presses**, friction clutch, 20 in. stroke.
2—**DGG-55 Ferracute Straight Sided Geared Presses**, friction clutch, 16 in. stroke.
1—**No. 37 Bliss Stamping Press.**
1—**No. 68 Double Action Press.**
1—**Waterbury Double Action Press**, back geared, 20,000 lb.
1—Geared Perforating Press.
1—Waterbury Farrel Hydraulic Press, 500 ton pressure.
1—**No. 168-N Bliss Automatic Press**
2—**No. 119½-K** Bliss Automatic Presses.
1—**No. 19½** Grip Feed Press.
1—**No. 4 Back Geared Back Wheel Leffler Press.**
2—**No. 21 Bliss Power Stamping Presses.**
1—**No. 20 Bliss Power Stamping Press.**
1—**No. 18 Bliss Power Stamping Press.**
1—**No. 75 Bliss Back Wheel Press.**
1—McDonald Three Die Double Action Press.
2—McDonald Slitters.
1—Double Crank Arch Press, 38 in. between uprights.
1—3½ ft. Radial Drill.
8—American Fox Monitor Lathes, 18 x 6, latest type.
1—No. 2A Owen Universal Miller.
1—Mt. Gilead Hydraulic Press Co. Hydraulic Press, 15 tons pressure, platen 30 x 30.
4—Multiple Plunger Power Presses, 4, 6, 8 and 10 plungers.

R. ROTHSCHILD

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22—**Turret** and **Screw Machines.**
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15—Allen **Sensitive Drills**, 4 and 6 spindles.
6 ft. Dreses **Univ.** Radial Drill.
40 in. Lodge and Davis B. G. S. H. **Drill.**
Large Lot of **Boilermakers' Machinery.**
104—**Punch Presses**, assorted sizes—Single and Double Acting; weighing from 1,000 to 30,000 lbs. each.
18 in. and 24 in. stroke **Keyseaters.**
17½-ft. table Bement-Miles Horizontal floor Type **Boring, Drilling** and **Milling Machine**
1—**8 ft. Niles Vert. Boring Mill.**
1—8 ft. Sellers Vert. **Boring Mill.**
Dietrich & Harvey 60-in. **Universal Milling, Drilling** and **Boring Machine.**
60 in. Niles Vertical Car Wheel Borer.
1—**30 in. Niles Slotter.**
48 x 48 x 16 ft. Pond **Planer.**
5—**Shapers.**
54 in. Niagara Power Squaring Shear.

Large Stock of Hammers, Drops, Grinders, Bolt Cutters, etc.

Send for Complete Catalogue of Stock

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3—No. 16 Bliss Horning Presses.
1—Bliss Multiple Press 7 plunger Automatic.
1—No. 130 Max Ames Inclinable power press.
1—Brown Double action power press.
1—Standard Inclinable power press.

LATHES

2—Rahn & Laman 18 in. x 6 ft. Lathe, D.B.G. & Q.C. Cabinet legs (NEW).
1—Fay & Scott 18 in. x 8 ft. Lathe D.B.G. & Q.C.
1—Le Blond 16 in. x 8 ft. Lathe D.B.G.
1—Putman 26 in. x 12 ft. Lathe S.Q.C. & D.B.G.
2—Master 12 in. x 5 ft. Lathe single pulley drive S.Q.C. (NEW).
1—Pryble 22 in. x 6 ft. Spinning Lathe ball bearing 99% new.

DRILL PRESSES

1—5 ft. Bickford Radial Drill press.
3—New 20 in. Canedy Otto B.G. Drill Press.
1—2 spindle Allen high speed drill press.
1—24 in. Aurora B.G. Sliding head drill press.

MILLING MACHINES

1—No. 3 Plain Cincinnati miller.
1—1½ Garvin Universal Milling machine with dividing heads complete.
1—No. 0 Steptoe plain miller.

MONITOR LATHES

3—18 in. x 6 ft. American Monitor Lathes build in 1918-1919 complete.

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Pond 30 in. x 30 in. x 8 ft. Planer.

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No. 2 Long & Allstatter Bar Shear Capacity 6-in. x 1-in. flat, 1¾-in. round, 1¼-in. square bars.
72 x 72 x 24-ft. Niles Planer.
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42-in. Putnam Vertical Boring Mill.
No. 2-G Brown & Sharpe Automatic.
No. 0 Brown & Sharpe Automatics.
No. 52 National Acme Automatic.
20-in. Stockbridge Shaper.
16-in. Davis Shaper.

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4 ft. Bickford

Radial Drill

gear box drive, in excellent working condition.

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36 in. x 36 in. x 15 ft. Sellers

Planer

all feeds, single head on rail, excellent condition, $1650.00.

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BORING MILL

2 swivel heads on cross rail, geared feeds, Price $1500.

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Used Tools Excellent Condition

1—100 in. Niles-Bement-Pond vertical boring and turning Mill; good as new.
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2—No. 12 Nateo multiple spindle drills, each having ten spindles; new.
1—12 in. x 24 in. Modern plain grinder.
1—Springfield univ. gauge grinder with motor.
1—⅜ in. Schuster riveter.
1—No. 10 Racine saw.
1—No. 11½ Higley 3 in. cold saw.
1—No. 1 Garvin vertical automatic tapping machine.

Federal Machinery Sales Co.
16 No. Jefferson St., Chicago
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Send Us Your Inquiries

We have the *largest stock* of used Machine Tools in the country, and *sell* on the *closest margin.*

Tell us your wants—
chances are we have it.

PENINSULAR MACHINERY CO.
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Good Used Desirable Equipment at Bargain Prices

4—9/16-in. Acme Mult-spdl. Screw Machines.
4—⅜-in. Model B Cleveland Automatics.
2—3¼-in. Cleveland Automatic Screw Machines.
1—1¼-in. Cleveland Automatic Screw Machine.
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4—3¼-in. Gridley Single-spindle Automatics.
1—Pratt & Whitney Hand Screw Machine.
1—Sullivan Air Compressor, capacity 3150 cu.ft. nearly new.
10—International Time Recording Clocks.
1—4-ft. Bickford Radial Drill.
1—6-ft. Niles-Bement Radial Drill.
1—3-spindle Taylor & Fenn Drill.
1—Kenworthy Annealing Furnace.
1—No. 3 B. & S. planer type Grinder.
1—Blanchard Vertical Grinder.
20—Automatic Polishing Lathes.
1—30-in. x 16-ft. American Lathe.
1—3-in. x 36-in. J. & L. Turret Lathe, geared head.
1—Pond 30-in. x 3-in. x 8-ft. Planer.
1—Putnam 30-in. x 30-in. x 10-ft. Planer.
6—Becker Large Hand Millers.
4—No. 7-H Lincoln type Milling Machines, Becker.
4—No. 12 P. & W. Lincoln type Milling Machines.
12—12-in. P. & W. Automatic Milling Machines.
1—Perkins Double Action Cam Press, weight 22,000 lbs.
1—No. 73½ Bliss Press.
1—No. 2 Bliss (Stiles pattern) Press.
1—No. 59 Toledo Press, ⅞-in. stroke, plain Fly Wheel Type.
1—Double End Punch & Shear, shearing capacity 1-in. cold.
1—Fitchburg Traveling Head Shaper.
1—16-in. Torrington Slitting Machine.
1—10-ft. Geo. A. Ohl Power Squaring Shear.
1—⅛-in. Schuster Riveting Machine.
1—Toledo ¼-in. Spot Welder.

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NILES 44-IN. VERTICAL BORING MILL

NILES-BEMENT-POND CO.
SERIAL NO. 15,341. 90% NEW.

Gear Box Drive, fitted with one Tilted Turret Head and one Swivel Head. 12 milled T slots. Set of adjustable and reversible jaws. Four Change Gear Boxes. Two Tool Holders, Etc.

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NO. 10. FOSTER

geared friction head
SCREW MACHINE

with automatic chuck and wire feed, power feed to the turret slide and power cross feed to the cut off slide, swing over bed 20-in., swing over cut-off slide 6⅝-in., diameter of hole in spindle 3½-in., wire feed capacity 3½-in., diameter of turret 12-in., diameter of holes in turret 2½-in., width of belt two grade cone 6-in., net weight 5550-lb., floor space 3-ft. 2-in. x 9-ft.

The Standard Machinery Co.
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Immediate Delivery

Type "A" **Briggs** Milling Machine.
24-in. **Gisholt** Standard Turret Lathe.
30-in. x 30-in. x 6-ft. **Pond** Planer, one head.
6-in. x 32-in. **Norton** Grinder.
14-in. x 50-in. **Norton** Grinder.
No. 0 **Giddings & Lewis** Horizontal Boring Mill.
18-in. x 10-ft. **Bradford** Heavy Pattern Lathe, 3 step cone, double back gears.
32-in. x 18-ft. **Bradford** Lathe, C. R.
No. 0 **Foster** Screw Machine.
No. 1 **Foster** Screw Machine.
No. 23 **Toledo** Double Action Press.
No. 5 **Rearwin** Die Filer.

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December Specials

Silver 20-in. B. G. Drills.
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Sipp 1 spindle 14-in. Sensitive Drills.
Allen 5 and 6 spindle Drills.
Brown & Sharpe No. 2 Surface Grinders.
Pratt & Whitney 14-in. vertical Surface Grinders.
Hjorth Bench Lathe on stand, complete.
Champion 16 x 6 Engine Lathe.
Hendey 14 x 6 Q.C.G. Engine Lathe.
Hendey 16 x 7 Q.C.G. Engine Lathe.
Davis 18 x 8 Engine Lathe.
Pratt & Whitney 12-in. Heavy semi automatic Miller (new).
Brown & Sharpe No. 12 and No. 13 Plain Millers.
Becker No. 7H Lincoln Type Miller.
Leblonde No. 1½ Universal Miller.
Brown & Sharpe No. 3A Universal Miller.

BOTWINIK BROS.
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FOR SALE

Hammer, Truck, Lathes, Grinder

2—21-in. **Le Blond Lathes**, equipped with 15-in. three-jaw Universal Chucks and Taper Attachments
1—**J. A. Stowell Grinder**, Saxon No. 2.

RICHMOND FORGINGS CORPORATION
(Acca) Richmond, Va.

38 in. x 12 ft. Fifield

Lathe

triple gear, face plate drive, large hollow spindle, compound rest, excellent working condition, $1500.00.

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GRIDLEY AUTOMATICS

Six 2¼ in. Multiple Spindle, used on light brass less than six months, condition like new, with lot of extra parts, $3,000 each. Thirteen 2¼ in. S. S. fitted for magazine attachment and threading, condition A.1., lot of extra parts and tools. Price, $1000 each. Less in quantities.

Lot of other Multiple and Single Spindle Automatics in A.1. condition and other new and used machinery for immediate delivery.

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GRAND RAPIDS SPECIALS

1—No. 4 Buss Keyway Broaching Machine.
1—No. 2 J. N. La Pointe Broaching Machine.
1—No. 4 Nutter & Barnes Cut Off Machine.
1—No. 4 Cochrane Bly Cut Off Machine.
1—No. 51 Canedy-Otto 2½ ft. Wall Radial.
1—3 ft. Fosdick Holloway Radial.
1—20-in. Barnes All Geared Drill.
1—16-Spindle Grand Rapids Multiple Drill.
1—No. 6-A Bryant Chucking Grinder.
1—125 lb. Kane & Roach Power Hammer.
1—24 x 10 Schumacker-Boye Engine Lathe.
1—18 x 10 Schumacker-Boye Engine Lathe
2—2 x 24 J. & L. Turret Lathes.
1—3 x 36 J. & L. Turret Lathe
1—No. 5 Foster Turret Lathe.
1—No. 3 Dwight Slate Marking Machine.
1—No. 2 H Becker Profiling Machine.
1—1-in. Pratt & Whitney Spline Miller.
1—30 x 30 x 8 Pond Planer.
1—No. 3 Kane & Roach Multiple Punch.
1—L-10 Rock River Punch & Shear.
2—A-6 Pangborn Sand Blast Outfits.
1—1½-in. Cleveland Automatic Screw Machine.
1—2-in. Cleveland Automatic Screw Machine.
1—20-in. Smith & Mills Crank Shaper.
1—96-in. Ohl Power Squaring Shear, 16-Ga.
1—50 lb. Davis Bournonville Welding Outfit.

McMULLEN MACHINERY CO.
"Everything In Shop Equipment"
Grand Rapids, Mich.

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SQUARING SHEAR
1—No. 500 3/16-E Toledo. Capacity 8 ft. long, 3/16 in. plate, 15 in. gap.

GEAR CUTTERS
3—36 in. Fellows Gear Shapers. Regular equipment.
1—No. 2B Newark for spurs and bevels. 24 in. capacity.

TURRET LATHES
1—No. 4 Warner & Swasey Universal.
3—3 x 36 Jones & Lamsons. Geared feed.
1—2 spindle 17 in. Jones & Lamson.
1—24 in. Steinle. Single Pulley drive. 4 in. spindle hole.
2—No. 24 Geo. G. Prentice Semi-automatics. 4-spindle.

MILLING MACHINES
1—No. 3 Cincinnati Vertical.
1—No. 5 Brown & Sharpe Horizontal.
1—42 x 42 x 12 ft. Ingersoll. Slab type.

BEVEL GEAR GENERATORS
1—16 in. Bilgram. Regular equipment.
7—18 in. Gleasons. Regular equipment.

GRINDERS
1—No. 2 Landis Internal; hand feed.
1—No. 4 Gardner Double End Ring Wheel.

RADIAL DRILLS
1—2½ ft. American. Gear Box Drive.
1—2½ ft. Gang Sensitive.
1—5 ft. Western. Heavy type, plain, gear drive.

DRILL PRESSES
1—6 spindle Foote-Burt. Sensitive; ½ in. capacity.
1—6 Spindle Fox Sensitive; ½ in. capacity
1—1 x 6 Baker Bros. Vertical automatic.
1—8 spindle Baush Adjustable Drill Head. Cap. 8 in. circle, ⅝ in. drills.
1—No. 18 8 spindle Natco, arranged to 16.
1—No. 17 Foote-Burt, 4 spindle; rail type.
1—No. 1½ Foote-Burt, 4 spindle; rail type.

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E. B. STICKLEY MACHINERY CO.
217 E. CONGRESS ST., DETROIT, MICHIGAN

SHEAR

1—Rotary Ring and Circle Shear, capacity No. 10 gauge (New)

LATHES

1—20-in. x 10-ft. SPRINGFIELD All Geared Head Lathe, Quick Change Gear Type, (New)
3—18-in. x 8-in. SPRINGFIELD All Geared Head Lathe, Quick Change Gear Type, (New)
1—24-in. x 16-ft. ADVANCE Lathe, Quick Change Type, (New)

GRINDER

1—No. 3 Wilmarth & Marmon Surface Grinder, new.

MILLER

1—Horizontal 26-in. between housings, 56-in. table length (Used)

PLANER

1—Used 30-in. x 30-in. x 16-ft. Harrington

SWIND MACHINERY COMPANY
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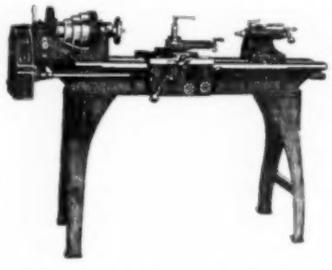
A Bargain in NEW STAR LATHES



All our stock of Star Lathes are guaranteed by the well-known "Fairbanks O. K."

The termination of our agency for this line enables us to offer new star lathes from stock at a discount of 15% in regular prices. Stock includes 9, 11, 12 and 13 inch sizes. Quick change attachments for 11 and 12 inch sizes if desired.

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For list of branches, see page 142

SECOND HAND

MACHINERY

BORING MILLS
3—24 in. Bullard vertical turret lathes, 4-jaw chuck, latest pattern.
4—30 in. Bullard boring mills, 3-jaw combination chuck.
34 in. Colburn vertical, geared feed.
36 in. Bullard Rapid Production type vertical turret lathe, 3-jaw chuck.
50 in. Baush vertical, two swivel heads.
72 in. Cincinnati, latest pattern, two swivel heads.
Binsse horizontal, 4 in. bar.

DRILLS
4—No. 117 Moline "Hole Hog" heavy single spindle.
No. 11 NATCO multi-driller, 12 in. round head.
No. 310 Baker Bros. high speed heavy duty, with compound table.
36 in. Wm. E. Gang plain radial.

GEAR HOBBERS
18 in. No. 2 Farwell.
18 in. Gould & Eberhardt.

GRINDERS
No. 10 Brown & Sharpe plain.
No. 70 Heald internal.

PLANERS
24 in. x 24 in. x 6 ft. Cincinnati.
36 in. x 36 in. x 8 ft. Cincinnati, two heads.
26 in. x 26 in. x 8 ft. Niles, two heads.
36 in. x 36 in. x 10 ft. Niles, two heads.
60 in. x 60 in. 12 ft. Gleason, three heads.
66 in. x 66 in. x 17 ft. Harrisburg, two heads.

MISCELLANEOUS
2—3 in. Hurlbut-Rogers cutting off machines.
2½ in. Oster cutting off and reaming machine.
Norton balancing machine, with two uprights.
50 lb. Beaudry power hammer, belt driven.
No. 2 Mitts & Merrill key seater.
No. 4 Hendey Lincoln type miller.
4—20 in. Walcott shifting belt shapers.

Marshall & Huschart Machinery Co
17 So. Jefferson St., Chicago, Ill.

Will make very attractive and special price on

11—14 in. DAVIS NEW SHAPERS

Cone driven. They are boxed for export. In Fitchburg today for immediate delivery. Wire for price.

WILLIAM H. SAVAGE
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No. 0 Fosdick

Horizontal Boring and Drilling Machine

Longitudinal travel of spindle 26 in.
Made by
Giddings & Lewis.
95% new.

JOSEPH BEAL & CO.
465-471 Atlantic Ave., Boston, Mass.

TOOLS FOR IMMEDIATE SHIPMENT
24-in. Steinle Turret Lathes.
8 x 60-in. Fitchburg Low Swing Lathe.
Landis Universal Grinder.
G. & E. 36-in. Gear Cutter.
16, 20 and 24-in. Barker Crank Shapers, new.
34-in. Bullard Boring Mill, Turret Head
36 x 36-in. x 18-ft. Pond Planer.
1½-in. S. & K. Hand Screw Machine.
14-in. x 6-ft. Hamilton Lathe, h.s., comp. rest.
18-in. x 8-ft. Hamilton Lathe, dbl. bk. gr. New.
1¼-in. Wood Hand Screw Machine.
3½-in. Canedy-Otto Radial, plain. New.
Grand Rapids Grinder, Cutter and Reamer.
Miller No. 2 B & S., heavy, plain.
2 x 24 and 3 x 36 J. & L., double equipment.
Boring Mill, 10 ft., 2 swivel heads.
3—No. 32 Kempsmith Production Millers.
2—Napier Band Saws.
Drill Grinders, both new and used.
12 x 10 and 9 x 8 Chicago Pneumatic Air Compressors.
No. 52, 53 and 56 National Acme Screw Machines.
THE OSBORNE & SEXTON MACHY. CO.
Columbus, Ohio
Dayton Office, 1118 Lindsey Bldg. 'Phone 152

Available Now!

For Immediate Delivery

506

Milling Machines

250 Hendey No. 4

250 Becker No. 7H

6 Ingersoll (New) 24 x 24 x 12 Heavy Duty Horizontal Slab Milling Machines.

30 x 24 x 10 Ingersoll, with 2 Vertical Heads

36 in. x 24 in. x 20 ft. Ingersoll with 2 Vertical Heads on Cross Rail with 4 Spindles.

54 x 24 x 20 ft. Ingersoll with 3 Heads on Cross Rail with 5 Spindles.

Our recent purchase from the U. S. Government Army Supply Base enables us to offer tremendous reductions in price. Users should anticipate their wants to suit their requirements.

Wire or write number of machines wanted. Description circular mailed upon request.

FROM OTHER PURCHASES

Milling Machines

No. 5 Becker Vertical.
No. 3 Brown & Sharpe Vertical.
No. 3 H. Le Blond Horizontal Full Universal. Fully equipped with Universal Dividing Head.
Newton 33 in. Swing Power Feed Compound and Rotary Tables.
Niles 48 in. swing—same.
Ingersoll 30 in. x 24 in. x 10 ft.
Lees Bradner No. 12 External Thread Milling Machine, long bed type 8 ft. 6 in. centers, 10 in. swing.

HAMMERS, PUNCHES, SHEARS

1000 lb. Lennox Friction Board.
1250 lb. Massillon Steam Drop.
Pels Steel Plate Shear for 15 in. I Beams.
800 lb. Erie Single Frame Steam (2).
1500 lb. Erie Single Frame Steam.

TURRET LATHES AND SCREW MACHINES

24 in. Gisholt with 4 way Turret Tool Post on carriage. Tilted Hex Turret on Bed with Power Rapid Traverse. Taper Attachment Screw Cutting 2 step Cone Triple Geared, 6¼ in. hole in spindle (10).
28 in. Pond Rigid—Same—(2).
No. 1 Pratt & Whitney Hand Screw Machines $\frac{5}{16}$ in. Auto. Chuck capacity (8).

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30 6-A

Potter & Johnstons

17,000 Serials
Practically new

$800 Each

F.O.B. Cars

Industrial Machinery Corporation

Jersey City **New Jersey**

A. G. Schoonmaker & Sons, Inc.

25 Church St., New York City

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Five ton 3 motor 220 volt D.C., 25-ft. span Electric Traveling Crane.
10 Ton 3 motor 220 volt D.C., 47-ft. span Morgan Traveling Crane.

HORIZONTAL BORING MACHINES

3-in. Bar **Betts** Knee Type Star Feed Facing Head complete, in excellent condition.
4-in. Bar Cylinder Boring and Facing Machine **Beaman & Smith** motor drive, 28-in. swing, 48-in. centers, weight 12,000 lb. New condition.
4-in. Bar **Fostick** Horizontal **Boring, Drilling and Milling Machine**; No. 2 motor driven.
60 in. **Bickford Vertical Boring** and **Turning Mill.** Very good condition.

LATHES

30 in. x 14 ft. **Niles Bement Pond Lathe**, compound rest, solid spindle.
5 step cone. Complete with countershaft.
27-in. x 14-ft. **Lodge & Shipley** motor drive, modern late type machine Q.C.G. 2¼-in. hollow spindle, thoroughly rebuilt.
26-in. x 20-ft. **Perkins Lathe**, C.R., P.C.F. Fully equipped, thoroughly rebuilt.
26-in. x 14-ft. Pond C.R., P.C.F., 8-ft. 9-in. centers, thoroughly rebuilt.
24-in. x 18-ft. **LeBlond** Q.C.G., C.R., P.C.F., 2¼-in. hollow spindle 13-ft. centers, motor drive.
18-in. **x 10-ft. Schumacher Boye, Emmes** D.B.G., Q.C.G., C.R., 1½-in. hollow spindle, thoroughly rebuilt.
18-in. **x 6-ft. Hamilton** D.B.G., C.R., 1½ **in. hollow spindle, taper attachment.**

MILLING MACHINES

No. 24 Garvin Vertical, table 50-in. x 14-in., latest type, new condition.
No. 1 **Rockford** Plain, table 30-in. x 7½ in. new condition.

SHAPERS

26-in. Cincinnati Shaper, triple geared Excellent condition.
28-in. **Jungest** Crank shaper, box table. Complete with vise and countershaft. excellent condition.

MISCELLANEOUS

Drills—2—14-in. Allen High speed ball bearing **Drills.** New Condition.
Grinder—No. 2 Modern Universal. Practically New, **table 10 x 27-in., complete** equipment.
Hammer—150 lb. Beaudry No. 6 Peerless Power Hammer.
Presses—5 No 60½ Bliss Reducing Presses rack and pinion movement. Adjustable stroke 4 to 42-in., weight 12,500 lb.
1-in. **Acme** Bolt Heading and Forging Machine. Complete with dies.
Saws—5 No. 2 Cochrane & Bly Metal Saws 15-in., blade capacity 4½-in., round 4-in., square in. I-beam.

1500 lb. Merrill Bros. Steel Frame Board

Drop Hammer

excellent condition.

JOSEPH BEAL & CO.
465-471 Atlantic Ave., Boston, Mass.

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3 in. x 36 in. Jones & Lamson, geared head, complete.

CHUCK EQUIPMENT
$1000.

Bertolette Machine Tool Company
Jersey City, N. J.

FOR QUICK SALE

SENSITIVE DRILLS

NEW 4 spindle Sipp high speed, quick change, No. 2 Morse taper.
4-spindle Sipp high speed, quick change No. 2 Morse taper.
Two 4-spindle Avey high speed, No. 2 Morse taper.
6-spindle Pratt & Whitney, No. 1 Morse taper.
4-spindle Pratt & Whitney, No. 1 Morse taper.
3-spindle Pratt & Whitney, No. 1 Morse taper.
12-in. Barnes, variable friction speed.

MULTIPLE DRILLS

14-spindle Baush vertical, No. 3 Morse taper, capacity 1-in.
20-spindle Fox, No. 1 Morse taper, capacity ¾-in.
16-spindle Fox, No. 1 Morse taper, capacity 1½-in. in ¾-in.
14-spindle Fox, No. 1 Morse taper, capacity 1¼-in. in ⅝-in.

SHAPERS

18-in. Stockbridge back geared crank.
NEW 16-in. Steptoe back geared crank.
26-in. x 72-in. Niles traveling head crank.
16-in. Steptoe geared, belt drive.
15-in. Pratt & Whitney geared.
15-in. Hendey friction.
12-in. Hendey friction.

LATHES

NEW 20-in. x 8-ft. Walcott, double back geared, cone drive. At half price.
20-in. x 12-ft. Prentice, 8-ft. centers, cone drive.
20-in. x 14-ft. Flather, 10-ft. 6-in. centers, back geared, cone drive.
NEW 16-in. x 8-ft. Rahn Larmon, quick change, double back geared, cone drive. At half price.
NEW 16-in. x 6-ft. Cleveland, 25-in. centers, cone drive.
16-in. x 6-ft. American, 21-in. centers, quick change gear, single pulley drive.
14-in. x 7-ft. Lodge-Shipley, quick change, 48-in. centers, cone drive.

PIPE MACHINES

6-in. Jarecki, 1½-in. to 6-in., cone drive.
6-in. Oster, 1-in. to 6-in., cone drive.
4-in. Saunders, 1-in. to 4-in., cone drive.

New York Machinery Exchange

Machine Shop and Warehouses:
220-236 Culver Avenue,
Jersey City, N. J.

Offices: 50 Church St., N. Y. City

36 in. x 12 ft.
Woodward & Powell

Planer

excellent condition, four heads.

JOSEPH BEAL & CO.
465-471 Atlantic Ave., Boston, Mass.

Blowers—Exhausters—Fans
Large variety of sizes and styles for all services. Air Compressors and Receivers high and low pressure.

Diamond Disc Grinder
double, full Universal swinging tables, 3—18-in. Discs, Gluing Press and Disc Cabinet, A1 condition.

Band Saws
36-in. Tilting Greaves & Klusman, 30-in. strictly modern Fay & Egan 95% new, 30-in. Rigid Table.

Swing Cut-Off Saws
belted. 2 Rotary Geared all bronze Portable Pumps with 110-220 V., D.C. motors. 1 Warner 220 V., D.C. Electric Elevator Engine.

Factory Dust Blowers and Vacuum Cleaners
Get our list of available Machine Tools and FOUNDRY EQUIPMENT

CLIFTON-PRATT CO.
Cincinnati, Ohio

1000 MACHINES

From which to choose at pre-war prices until we have reduced our stock $50,000.

Partial List of Our Stock

DRILLS
Multiple and Radial
4—Radial Drills, 3-ft., 4-ft., 5-ft., and 6 ft., both plain and universal.
3—16 to 24 Spindle Mult. Drills.
1—No. 4 Foote-Burt 6-Spindle Radial Drill.
25—Drills, 10 in. Sensitive to 28 in. S.H.

GRINDERS
3—10 x 36 Thompson Full Universal.
3—No. 2 Oakley Cutter and Tool Grinders.
25—Grinders, Plain and Univ., various sizes.
3—No. 60 Heald Grinders.

SHEARS AND SHAPERS
10—Shapers, 16 to 24 in. stroke.
1—12 ft. Bertsch Squaring Shear, 12 gauge capacity.

MILLERS
6—Rockford Univ. Mills, 1½ to 2½.
3—No. 1½ American Plain and Universal.
10—No. 32 Kempsmith, Lincoln type.
1—No. 1 Kempsmith Univ. Mill, with vertical att.

TURRET AND SCREW MACHINES
19—24 in. Gisholt Turret Lathes.
12—No. 2 Smith Hand Screw Machines, 1⅛ in. wire feed capacity.

PRECISION AND ENGINE LATHES
35—Engine Lathes, from 6 to 36 in. swing and 4 to 20 ft. bed.
4—Precision Lathes, with Grinding att.; new but cheap.

PLANERS
1—32 x 32 x 10 ft. Fitchburg.
1—40 x 40 x 10 ft. New Haven.
1—26 x 24 x 8 ft. Pond, 2 heads.

MISCELLANEOUS
1—52 in. Bertsch Multiple Punch, 6 in. gap; 51 holes ¼ in.; 12 gauge steel.
1—40 lb. Bradley Helve Hammer.
1—26 in. Brown & Sharpe Gear Cutter.
1—No. 6 Quickwork Rotary Shear, 48 in. throat, 1 in. capacity.

Send Us Your Inquiries

Wayne Machinery Co., Ft. Wayne, Ind.

BRANCHES:
18 W. Second St., Dayton, Ohio 121 So. Third St., Louisville, Ky.

No. 3 LaPointe Single

Broaching Machine

in excellent condition.

JOSEPH BEAL & CO.
465-471 Atlantic Ave., Boston, Mass.

AN OPPORTUNITY SELDOM OFFERED

18 No. 56 National Acme Automatic Screw Machines

4-Spindle, 2¼-in. Cap. A-1 Condition.

For Immediate Delivery at Attractive Price.

We also have in stock No. 52, No. 53, No. 54 and No. 515 National Acme Automatic Screw Machines which can be had at a very attractive price.

AMERICAN MACHINERY EXCHANGE, Inc.
219 Center Street, New York City
Phone Canal 642

ENGINE LATHES
1—36 x 18 LeBlond, motor drive.
4—36 x 22 Lodge & Shipley, motor drive.

PLANERS
1—42 x 22 Flather, three heads.
1—48 x 22 Cincinnati, four heads.
1—72 x 60 x 20 Gray, four heads.

BORING MILLS
1—3⅛ in bar Landis No. 35 horizontal
1—4 in. bar Barrett horizontal.
1—5 in. bar Barrett horizontal.
5—Rooksby horizontal.
1—6 in. bar Barrett horizontal, 68 in swing
1—Grant, vertical car wheel, 44 in.

SLAB MILLERS
1—42 x 10 Ingersoll.
5—42 x 14 Ingersoll, two vertical heads

MISCELLANEOUS
1—30 ton Case Crane.
2—12 Spindle Gardam Multiple spindle drills.
1—12 x 42 Landis Grinder.

Vonnegut Machinery Co.
Indianapolis, Ind.

NEW HARDWARE and MILL SUPPLIES

25% Below Market

95% Packed in Original Wrappings

consisting of

Drills, Wrenches, Shovels, Blacksmith Tools Punches, Chisels, Tool Handles, Abrasive Wheels, Axes, Augers and Bits, Wire Cloth, Fencing, Ash Cans, Fibre Cans, Oilers, Hinges and a general stock of Mill supplies.

Send for Detailed List with Prices

NATIONAL PIPE & SUPPLY CO.
907 Liberty Bldg., Philadelphia, Pa.

24 in. x 12 ft. Lodge & Shipley, quick change

ENGINE LATHE

taper attachment, $1450.

Bertolette Machine Tool Company
Jersey City, N. J.

REAL INVESTMENT *in* MACHINE TOOLS

18 in. Acme Turret Lathe.
2 in. Cleveland Automatic.
24 in. Pratt & Whitney Turret Lathe.
No. 00 Brown & Sharpe Hand Miller.
No. 1 Landis Universal Grinding Machine.
1½ Cleveland Automatic for Shaft Work.

Several Gridley Automatics, Warner & Swasey Screw Machines and other items.

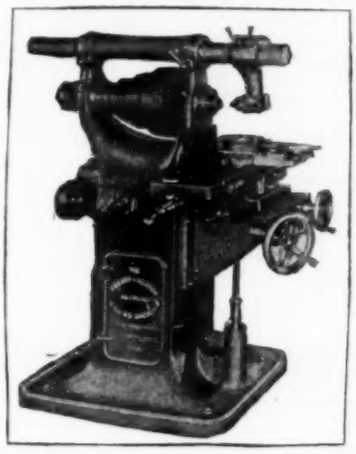
Tools Right—Prices Right. Write for particulars.

THE CROWN CORK AND SEAL CO., Baltimore, Md.

HERE'S A

No. 1 HENDEY MILLER

FOR SALE



A very nice tool room milling machine. 90% new with arbor (*not shown*), vise and countershaft. Crated F. O. B. Bridgeport, Conn.

Quick change feeds.
4-step cone, 3-in. belt.
Capacity—10 in. x 32 in. x 18 in.
Power or hand feed.
Hollow spindle.
Brown & Sharpe No. 10 taper spindle.
Double friction countershaft.

Guaranteed First Class

***Price* $685.00**

We will ship this Miller to any reliable concern on receipt of order. Payment to be made when it arrives at your freight station and found satisfactory.

J. L. Lucas & Son, Inc., 3 Fox St., Bridgeport, Conn.

FOR SALE

Cincinnati Universal Miller No. 2.
Kempsmith No. 9 Plain Miller.
Garvin No. 13 Plain Miller.
Fox No. 3½ Hand Millers, Power Feed.
Wilmarth & Marmon No. 1 Surface Grinders.
Brown & Sharpe No. 3 Universal Cutter and Reamer Grinders.
B. & S. No. 2 Surface Grinder.
Assortment Precision Bench Lathes.
20-in. Ohio Shaper, B. G.
20-in. Whipp Shaper, B. G.
16-in. Whipp Shaper, B. G.
20-in. Excelsior and Champion Drill Presses.
Allen B. B. Sensitive Drills, 4, 5, and 6 Spindles.
10—V & O No. 0 Power Presses, 1½ Stroke Dial Feeds.
20—V & O No. 01 Power Presses 1½ Stroke Roll Feeds.
Z & H No. 5 Power Presses.
Warner & Swasey No. 2 and No. 4 Turrets.
Full Line of Screw Cutting Lathes.
Melting and Annealing Furnaces.
Jewelers Machinery and Equipment.
Other Tools too Numerous to Mention.

MORRIS MACHINERY CO.
93-105 Chestnut St., Newark, N. J.

Slightly Used Machines—Fully Guaranteed

1—No. 1 Lucas Boring Mill.
1—42 in. Gisholt Boring Mill.
1—30 in. Bullard Boring Mill.
1—28 in. Barnes back geared Drill.
2—24 in. Barnes Vertical Drill Presses.
1—20 in.—6 spindle John Barnes Gang Drill.
6—Sigourney Plain Bearing Sensitive Drills.
6—Pilton Plain Bearing Sensitive Drills.
2—No. 25 Foote Burt Drills.
2—No. D4 Colburn Drills.
1—22 in.—4 spindle Barnes Gang Drill.
1—No. 17 Foote Burt Drill—4 spindle.
1—No. 12 Modern Grinder.
1—Safety Emery Wheel Grinder—Planer Type.
1—No. 3 Brown & Sharpe Automatic Gear Cutter.
3—No. 17 Besly Disc Grinders.
1—6 x 32 Norton Grinder.
1—3 spindle Gould & Eberhardt Gear Rougher.
1—36 in. Fellows Gear Shaper.
1—9 x 14 Porter Cable Lathe.
1—30 x 14 ft. Boye & Emmes Engine Lathe.
4—No. 3 A Warner & Swasey Turret Lathes.
1—26 x 12 ft. Greaves & Klusman Engine Lathe.
3—3¼ Gridley Automatics single spindle.
2—2¼ Gridley Automatics Four Spindle.
Cleveland Automatics as follows:
2¼ in.—2⅝ in.—3¼ in.—⅝ in.—2 in.—⅝ in.
No. 52 and 55 National Acme Automatics.

M. J. WALSH MACHINERY COMPANY
Milwaukee, Wisconsin

---

36 in. x 36 in. x 8 ft.
Pratt & Whitney

Planer

two heads on rail, good working condition, $1500.00.

JOSEPH BEAL & CO.
465-471 Atlantic Ave., Boston, Mass.

---

48 in. x 36 ft. Niles

ENGINE LATHE

triple geared, face plate drive, with blocks to swing 60 in., $2750.

Bertolette Machine Tool Company
Jersey City, N. J.

The Searchlight Advertising in This Paper

is read by men whose success depends upon thorough knowledge of means to an end—whether it be the securing of a good second-hand piece of apparatus at a moderate price, or an expert employee.

The Best Proof

of this is the variety of this journal's Searchlight ads. Without a constant and appreciable *demand* for such machinery or services, by its readers, the market-place which these advertisements represent could not exist for any length of time.

—

Are you using the Searchlight Section?

0200

No. 2—62 in.

Horizontal Boring and Drilling Machine

4 in. bar, arranged for motor drive with D. C. motor.

Made by
Niles-Bement-Pond Co.

JOSEPH BEAL & CO.
465-471 Atlantic Ave., Boston, Mass.

Testing Machine

Olsen Universal 100,000 lb. capacity Testing Machine, four screw type, with accessories for tension and bending tests, complete with autographic attachment and arranged for motor drive including 2 hp. Westinghouse motor, 220 volt, 60 cycle, 3 phase. Has had very little service and is in first class condition. Manufacturer's price for same machine $5000.

Our price will interest you.

F. H. CRAWFORD
305 Broadway, New York
Telephone Worth 819

USED MACHINERY FOR SALE

5—Defiance 18 in. Variety Turning Lathes.
1—Standard Mfg. Co. Drill Press, table feed, Morse taper No. 2.
1—Garvin No. 0 Duplex Horizontal Drilling Lathe, Screw Hand Feed, mounted in pan.
1—Deming Oil Pump with ¾ hp. A.C. Motor, 3 phase, 60 cycles, 220 volts.
1—Keller Roll Cutting Machine, Type Q.
1—Diamond Cupola Polishing Frame, Special.
2—Langelier Double Action Horizontal Drill Presses, each equipped with two drill heads, carrying five drills each.
2—Langelier 5 spindle Vertical Drill Presses.
1—Holmes Tapping Machine, Bench type.
1—Olsen Universal Efficiency Testing Machine.
8—Garvin No. 1 Automatic Tapping Machines.

Ready for immediate delivery from Bridgeport, Conn.

For particulars apply to

RUSSIAN REMINGTON RIFLE CONTRACT TRUSTEES
709 Sixth Avenue, New York City
Phone, Bryant 7949

GRINDER

12 in. x 36 in. Modern Plain Grinder, self-contained countershaft, practically new, $1250.

Bertolette Machine Tool Company
Jersey City, N. J.

An Exceptional Buy

8—Dow Milling Machines No. 1, new; $975.00.
1—24 in. x 24 in. x 6 ft. Pond Planer, used; $950.00.
1—2 x 24 H L Turret Lathe, used; $420.00.
1—3 x 36 J L Turret Lathe, used; $900.00.
10—20 in. Back Geared Frontier Drills, new; $150.00.
12—20 in. Back Geared Silver Drills, new; $195.00.
All sizes Walcott Lathes, bargains.
All sizes Carroll Jamieson Lathes, bargains.
1—No. 2 Kempsmith Universal Miller, new; bargain.
1—No. 2 Kempsmith Plain Miller, new; bargain.
1—24-in. Superior Drill Press, new; bargain.
Lowest price on steel and iron, bolts, nuts, etc.

We are continually in the market for good used tools, send us your list.

Write nearest Branch Office.

WILLIAM E. DUFF CO.
Machinery and Mill Supplies
215-17 North George St., York, Pa.
New York Mexico, D.F. Tokyo, Japan
Jacksonville, Fla. Osaka, Japan

HIGH-SPEED STEELS

ALSO ALLOYS — CARBONS

All standard makes and sizes. Rounds up to 6¾-in. Flats and Squares. Immediate shipment from our warehouse at surprising prices.

NESS TRADING COMPANY
Savannah, Ga.

F. H. NILES & CO., Inc.

MAIN OFFICE AND WAREHOUSE: 421 CLAREMONT AVE., JERSEY CITY, N. J.
New York Office: Woolworth Bldg. Phone: Barclay 4293

42-In. PUTNAM VERTICAL BORING MILL

LATEST TYPE — LIKE NEW — USED ONLY 2 MONTHS

1 Swivel head; 1-turret head; single pulley drive. Quick change speeds and feeds. Will take work 46 in. diameter.
The Manufacturer's price on this tool today is over $7,000.00. We are offering this Boring Mill at $4,950.00. F.O.B. our Warehouse.
This is your opportunity to acquire a NEW TOOL at a big reduction.
This is an example of our stock and the prices at which same is priced. Write for January booklet giving complete list of our stock of Machine Tools, Power, Electric and Contractors' Equipment.

PRESSES

1—97A TOLEDO DOUBLE CRANK PRESS, WEIGHT ABOUT 100,000 lb.
1—No. 59¾ Toledo Straight Side Tie Rod Frame.
1—No. 77½ Bliss Press, tie rod frame, friction clutch, 16-in. stroke.
4—D. 201 Ferracute Geared Presses.
3—D.G.G. 56 Ferracute Geared Presses.
1—D.G.G. 55 Ferracute Geared Press.
1—No. 59 Toledo Straight Side Tie Rod Frame Press.
1—No. 59¾ Toledo Straight Side Tie Rod Frame Press.

BORING MILLS

42 in. Putnam Vertical—1 Swivel and 1 Turret Head. Quick change Feed Gears—Single Pulley Drive.
1—60 in. Bullard Vertical arranged for D.C. Motor Drive, 2 swivel heads, geared feed.
1—5 in. bar Betts Horizontal arranged for D.C. Motor Drive.

DRILLS

28 in. Aurora Vertical Sliding Head, back geared.
23 in. Hoefer.
36 in. Currier Snyder Sliding Head Back Geared.

STEAM HAMMERS

600 lb. Lane Steam Hammer.
2000 lb. Erie Steam Hammer, single frame.

LATHES

1—84 in. x 25 ft. Putnam Geared Head, New.
50 in. x 20 ft. Pond Triple back geared.
38 in. x 16 ft. Pond M.T. Co., triple geared.
36 in. x 61 ft. 2½ in. Putnam Screw Cutting Triple Geared Lathe.
36 in. x 20 ft. New Haven, triple geared.
36 in. x 16 ft. Putnam, triple geared, (2).

PLANERS

1—72 in. x 72 in. x 24 ft. N.B.P. Planer, 4 heads.
1—60 in. x 60 in. x 22 ft. Niles, 4 heads.
2—48 in. x 48 in. x 14 ft. Powell, Four Heads, including new Westinghouse 230 V. D.C. Equipment.

RADIAL DRILLS

1—8 ft. Standard Baush, Heavy Type.
5 ft. Baush Back Geared Belt Driven, 4 step cone.
6 ft. Prentice back geared belt driven, 4 step cone.
3½ ft. Mueller Speed Box Drive, New.
2—3 ft. Dreses Speed Box Drive, direct connected to 220 volt, 60 cycle, 3 phase motor.

We also carry a complete line of new tools in stock. Send us your inquiries.

30 in. x 12 ft.
American Geared Head Lathe

Single pulley drive.
30 in. four-jawed Chuck fitted.
Condition like new.

JOSEPH BEAL & CO.
465-471 Atlantic Ave., Boston, Mass.

28 in. Gisholt
TURRET LATHE

taper attachment, price $900.

Bertolette Machine Tool Company
Jersey City, N. J.

NEW
GRINDING WHEELS

For all purposes. All grits, grades, shapes and sizes. Large quantity. Immediate shipment from our warehouse. Surprising prices.

NESS TRADING COMPANY
Savannah, Ga.

Attention: Firms Having an Overstock of Carbon and High-Speed Twist Drills For Sale

The Board of Education City of Chicago, will entertain proposals on the sale of new carbon and high speed twist drills in quantities, sizes from No. 70 to 1 inch diameter. Please quote size and make of drills and discount.

Address
FRED W. KRENGEL
Ass't Business Manager
Room 501-650 So. Clark St.,
Chicago, Illinois

It Pays to *Watch* This Page

EVERY ADVERTISEMENT on this page provides an opportunity for some owner to sell his machinery immediately. It will pay you to keep track of what other readers want.

If **you** need equipment and don't find it in the For Sale pages, put **your** card here. It will tell other readers what **you** want.

It Pays to *Use* This Page

0131

How Much War Department Surplus Property Can be Absorbed by Your 1921 Output?

Nearly one hundred thousand individual orders representing sales amounting to nine hundred million dollars is the staggering total of property disposed of through War Department sales to date.

The buying power of America has responded to these sales in a big way, many manufacturers looking to them as a regular source of supply.

Thousands of machines purchased through this channel are in operation. Thousands of motors, generators and other electrical equipment are supplying heat, light and power in every industry. Huge quantities of chemicals have found their way to use through these sales. Thousands of tons of iron and steel from this source have been wrought into every conceivable tool and commodity.

Now is the time to view your future needs

New products must be produced and sold on a different basis. A basis that recognizes that the 1921 output must be sold to a "buyers market." This necessitates marked economies in the purchase of equipment and supplies.

The total of machinery and engineering materials still to be offered, while enormous , is not inexhaustable, and this new and different market, with its necessary purchasing economies, promises an ever-growing demand for the remaining stocks.

Consider the possibilities of War Department sales from this angle. The more your 1921 output can absorb the better will be your position under the new selling conditions. The quicker you act the better your chances of sharing the opportunities offered.

Read Every Item On the Following Pages

WAR DEPARTMENT
"Surplus Property Sales"

Every Item of

Route This Advertisement Through Your Plant So

Eastern Division

122—Inside Calipers.
Location—Washington, D. C.

96—Calipers, firm joint, double No. 173—6 in. and 12 in.
Location—Pittsburgh, Pa.

3005

4—Condensers, W.E., 33 GH, mounted on wooden base; capacity 2.20 M.F., used in telephone service. Mfgr. Western Elec. Co.
Location—Philadelphia, Pa.

2—Connections, reducers, straight lengths, 20 in., one end 6 in., 8 in. ball holes 1⅛ in. diam. Parts for refrigerating plants.
Location—Philadelphia, Pa.

4—Conveyors, gravity sections, 22 in. x 121 in. iron frame.
Location—Baltimore, Md.

13636

2—Independent Engines; double swinging cylinders; compound geared; equipped with reversing valve.
Location—New York.

2752

1—Steam Engine, with generator, 85 hp.
Location—New Cumberland, Pa.

13625

92—Hammers, Riveting, steam operating No. 5. Little David chipping and parts.
Location—Norfolk, Va.

14200

9—Hammers, Riveting No. 90, with ⅞ in. button head rivet sets. Mfrd. by Ingersoll-Rand Co.
Location—New York.

13631

1—Hoist, 4 ton capacity with 12 in. lift, Wright High Speed.
Location—Norfolk, Va.

E-642

29,875 ft. Discharge Hose, 2 in. dia., 4 ply, 25 ft. lgths. Couplings and clamp attached.
Location—Pittsburgh, Pa.

E-643

12,500 ft. Discharge Hose, 2 in. dia., 4 ply, 25 ft. lgths. Coupling and clamp attached.
Location—Pittsburgh, Pa.

E-644

37,375 ft. Discharge Hose, 2 in. dia., 4 ply, 25 ft. lgths. Coupling and clamp attached.
Location—Pittsburgh, Pa.

E-645

20,400 ft. Discharge Hose, 2 in. dia., 4 ply, 25 ft. lgths. Coupling and clamp attached.
Location—Pittsburgh, Pa.

000

100 ft. Air Hose, ¾ in. wire bound.
Location—Pittsburgh, Pa.

List Continued On

WAR DEP

"Surplus Prop

Pertinent Interest

That Every Department May Benefit

E-640

3840 ft. Suction Hose, 2 in. dia., 4 ply, 15 ft. lgths. Coupling and clamp attached.

Location—Pittsburgh, Pa.

E-641

3510 ft. Suction Hose, 2 in. dia., 4 ply, 15 ft. lgths. Coupling and clamp attached.

Location—Pittsburgh, Pa.

E-882

40—Joints, extra heavy, double expansion parts. Refrigerating plant.

Location—Philadelphia, Pa.

17290

10—Machines, 32 in. slip roll curving and forming machines for bending No. 22 gauge corrugated sheets with standard corrugations 2 2/3 inches center to center, and 3/8 to 1/2 inch deep. Machine operated by 30 inch wheel with crank handle; can be fitted for belt drive. Pressure and gauge rolls will take work up to 10 gauge metal.

Location—Norfolk, Va.

20726

1—Motor, Electric, A.C. 150 hp., 400 volt, 3 phase.

Location—Washington, D. C.

20—Motor Generator Sets for power panels.

Location—Philadelphia, Pa.

1891

285 Gal. Oil for oil break switches, "Hi. Flash."

Location—New Cumberland, Pa.

E-270

10,556 Gal. Loom Oil.

Location—A.S.B., Brooklyn, N. Y.

E-271

8501 Gal. Lard Oil.

Location—A.S.B., Brooklyn, N. Y.

E-272

9939 Gal. Quenching Tempering Oil.

Location—A.S.B., Brooklyn, N. Y.

14715

61 ft. Malleable Pipe, 10 in.

Location—New York.

Next Page

MACHINERY AND ENGINEERING MATERIALS

LIST NO. 13

Sale by Negotiation

HOW TO ORDER

All orders and negotiations for materials offered in this list must be addressed to the Depot Quartermaster of the division where material is located. These divisions and the addresses of controlling offices are given below. To obtain a complete list of materials not listed in this advertisement, clip and mail the attached coupon.

LIST OF DIVISIONS AND CONTROLLING OFFICES

EASTERN DIVISION
59th St. and 1st Ave.
Brooklyn, N. Y.

CENTRAL DIVISION
1819 West 39th St.,
Chicago, Ill.

SOUTHERN DIVISION
Transportation Bldg.
Atlanta, Ga.

SOUTHWESTERN DIVISION
San Antonio, Texas

NORTHEASTERN DIVISION
Army Supply Base
Boston, Mass.

COUPON

Chief, Sales Promotion Section, Office of the Director of Sales, Room 2515, Munitions Building, Washington, D. C.

Important
Mail Coupon to This Address

Kindly send M. & E. M. List No. 13 in its entirety .....

Firm Name .....

Street Address .....

City ..... State .....

Signed by .....

American Machinist

ARTMENT
erty Sales

MACHINERY AND ENGINEERING MATERIALS
LIST No. 13 (Cont'd)

E-274

11,017 Gal. Quenching Tempering Oil.

Location—A.S.B., Brooklyn, N. Y.

E-273

10,796 Gal. Quenching Tempering Oil.

Location—A.S.B., Brooklyn, N. Y.

14721

52—Pipe Fittings, Nipples, assorted, 4 in. x 4½ in., 2½ in. x ¼ in. x ½ in.

Location—Norfolk, Va.

E-406

313,998 Cannister Steel Springs, 2 in.

Location—New York.

E-892

1—Steel Structural Shape, 48 x 7-4.

Location—Philadelphia, Pa.

14059

416½ ft. Matheson Pipe, 9½ in.

Location—New York.

Additional Items from
MACHINERY AND ENGINEERING MATERIALS LIST No. 13
To Be Sold By Negotiation

Aneriod Barometers
Cannister Bottoms
Compass Boxes
Ratchet Braces
Brass Grommets
Brass Fasteners
Brass Hock Parts
Brass Loops
Brass Rivets
Brass Slides
Brass Studs
Brass Washers
Load Covered Cable
Telephone Cable
Cable Releases
Canvas, O.D.
Concrete Push Carts
Compass Watches
Duck, O.D.
Dynamite
Gas Mask Eye Lenses
T.N.T. Cylindrical
Trench Fans
Flashlights
Fuses
Fuse Dust
Electric Knives
Machine Check Writers
Cannister Nozzles
Pipe Fittings
Sewer Pipe
Signal Plugs
Galvanized Bit Plugs
Structural Steel Shapes
Switch Boards
Rubber Tape
Cannister Tops
Tripods for Heliographs
Wrist Watches
Barbed Wire
Plain Copper Wire
Weaving Wire
Differential Cap Pulleys
Resonators
Heavy Wire Screens
English Screws
Shanks for Indicator Posts
Steel
Bar Steel
I-Beams
Structural Steel
Wrought Iron
Angle Posts
Screw Posts
Galvanized Rods
Corrugated Iron Shelters
Crucible Tool Steel
Steel Hoops
Strip Steel
Tool Steel
Air Tanks
Galvanized Iron Tanks
Vertical Tubular Boilers
Level Books
Plant Construction Books
Logging Carts
Beaded Edge Casings
Zincographic Chests
Campeners
Chief Operator's Desks
Drawing Boards
Motor Fuses
Meat Grinders
Knife Grinding Machines
Gum Box Board
Hob Nails
Engine Lathes
Motors for Grinders
B. T. Boilers
Portable Pile Drivers
Cavalry Plastrons
Boiling Plates
Screw Plates
Stocks & Dies
Coupling Poles
Payout Reels
Relay Racks
Hand Rip Saws
Spare Parts for Steam Engines
Buffalo Shears
Flagstaffs
Tanks, Wood
Film Tanks
Storage Tanks
Winches
Boilers and Covers
Cold Rolled Steel
Hoisting Engines
Concrete Mixers
Oil Reclamation Plants
Wire Firing Reels
Unions
Galvanized Iron Wire
Anti-Dimming Outfits
Very Pistol Shells
Bicarbonate of Sodium
Sulphur
Rubber Outlet Valves
Expanded Metal Sheets
Cement Glue
Litharge
Respirators, Horse
Warning Signals, Gas
Trench Sprayers
Rubber Tubing
Wire Outlet Valves
Horseshoe Nails

SURPLUS PROPERTY BRANCH
Office of Quartermaster General
Munitions Building, Washington, D. C.

WAR DEPARTMENT
"Surplus Property Sales"

AMERICAN MACHINIST

Think "SEARCHLIGHT" First

ADVERTISING RATES

POSITIONS VACANT—Business Opportunities and other undisplayed ads, 8 cents a word, minimum $2.00 an insertion.

POSITIONS WANTED—Evening work wanted, tutoring and other undisplayed ads of individuals looking for employment, 4 cents a word, minimum 75 cents, payable in advance.

ADD 5 WORDS for box number in undisplayed ads if replies are to any of our offices. There is no extra charge for forwarding replies.

DISCOUNT OF 10% if one payment is made in advance for 4 consecutive insertions of undisplayed ad.

ADS IN DISPLAY TYPE—Space is sold by the inch (30 in. to a page), the price depending upon total space used within a year, some space to be used each issue.

RATE PER INCH for ads in display space:

1 to 3 in., $5.00 an in.	15 to 29 in., $4.50 an in.
4 to 7 in., $4.80 an in.	30 to 49 in., $4.40 an in.
8 to 14 in., $4.60 an in.	50 to 99 in., $4.20 an in.

EMPLOYMENT

POSITIONS VACANT

POSITIONS WANTED

POSITIONS VACANT

Colorado

FOREMAN for machine shop in live Western city wanted employing about one hundred men on wide range of mining and industrial machinery; open shop. State experience and give references. P-641, Am. Mach., Old Colony Bldg., Chicago.

New Jersey

FACTORY manager wanted for machine shop producing small parts. P-650, Am. Mach.

New York

CUTLERY plant desires the services of a skilled steel engraver in marking stamps, fluting of knife springs and die work. P-649, Am. Mach.

EMPLOYMENT AGENCY

CHIEF tool designers and machinery draftsmen required for placement among employers in the Middle East and Great Lakes states. Salaries of $175 and up are offered. National correspondence service at your command. We assume preliminary expenses. General Engineering Agency, Pittsburgh, Pa.

EMPLOYMENT SERVICE

EXECUTIVES qualified for salaries of $2,500 to $25,000 and upward, are invited to communicate in strict confidence with the undersigned, who will conduct preliminary negotiations for such positions. The procedure used is peculiar to this service, differing essentially from all others, and is constructive and initiative, applied individually, and in no way jeopardizing present connections. Established 1910. Send name and address only for particulars. R. W. Bixby, Inc., 307 Lockwood Building, Buffalo, New York.

In Replying to "Blind" Ads

be careful to put on envelope the key number in the ad and also local address of office to which reply is sent.

10th Ave. at 36th St., New York.
935 Real Estate Trust Bldg., Phila.
533 Leader-News Bldg., Cleveland.
1570 Old Colony Bldg., Chicago.
531 Rialto Bldg., San Francisco.

Important

Original letters of recommendations or other papers of value should not be enclosed to unknown correspondents — send copies.

POSITIONS WANTED

Kansas

DESIGNING engineer open for position; American, age 29, married; technical education, executive ability; 12 years' practical experience. PW-655, Am. Mach., Old Colony Bldg., Chicago.

Massachusetts

ELECTRICIAN wants maintenance work, familiar alternating direct motors control, etc.; seven years in charge. PW-644, Am. Mach.

MECHANICAL designer on tools, jigs, fixtures and machine parts will qualify for responsible position; technical graduate with six years' designing and executive experience; will go anywhere. PW-651, Am. Mach.

EXECUTIVES

seeking superior positions find our confidential service extremely satisfactory. Let our Mr. B. H. Harrison confidentially negotiate for you suitable positions with proper employers, as he has successfully done for thousands of others since 1909. Inquiries invited.

THE NATIONAL BUSINESS BOURSE
Confidential Negotiators
Association Building—Chicago

WANTED
FOREMAN
Automatic Screw Machines

For both single and multi-spindle types. Must be capable executive. Good future assured to competent man in a large manufacturing concern in New England. All replies held confidential.

P-643—American Machinist
10th Ave., at 36th St., New York City

Experienced Executive

A man with long experience in foundry and manufacturing lines would like an executive position with a going and profitable manufacturing concern. Can invest $25,000.00 if the business warrants the investment.

PW638—American Machinist
Old Colony Bldg., Chicago, Ill.

POSITIONS WANTED

New York

INSTRUMENT MAKER, experienced on electrical and physical apparatus; also experimental work; thoroughly qualified; first-class references; available immediately. PW-652, Am. Mach.

MASTER mechanic—One who knows the maintenance and construction problems of a large plant thoroughly; open Jan. 1. PW-648, Am. Mach.

SUPERINTENDENT with 15 years' experience in the designing of tools and making the same for the manufacture of all kinds of interchangeable parts; especially familiar with deep drawing sheet tools. PW-647, Am. Mach.

TO the owner of a small factory: Large manufacturers employ able executives and hold them with large salaries. One of these men, thoroughly experienced in modern methods of production and management, as manager of your factory, would increase your profits. You would hold him by granting him stock in proportion to profits. Meanwhile, his salary requirements would be modest. Write for a personal interview. It will be of mutual advantage. PW-646, Am. Mach.

Rhode Island

PLANT superintendent or master mechanic, age 35, married; salary $300. PW-654, Am. Mach.

AGENTS AND SALESMEN

A Splendid Opportunity

Good, live representatives wanted in principal cities for a high-class, well established line of expansion boring tools and expansion reamers on commission basis. Davis Boring Tool Company, Inc., St. Louis, Mo.

Foreign Representation

Engineer, with office in New York, who spends several months each summer in England, France and Belgium would like to act as correspondent for a firm in any of the above countries in connection with representation or investigations. Also seeks an American firm wishing to have personal representation made on their behalf while he is abroad. Will furnish highest references; remuneration dependent on work. AS-562, Amer. Mach.

Machine Tool Sales Manager Available

Sales manager, machine tools. I have a good record as salesman and sales engineer with several lines which are leaders in their field and a very thorough mechanical training covering the manufacture of interchangeable parts and machine tool building. Would like to take hold of special line where the above qualifications will enable me to locate the market for the product and where high class sales service is necessary AS-609, Am. Mach

AGENTS AND SALESMEN

Representatives Wanted

Experienced representatives wanted to acquire exclusive territory rights to sell a high-class adjustable snap gauge, on a commission basis; splendid opportunity for a live man. AS-601, Am. Mach.

Salesmen Wanted

Salesmen, experienced setting small tools, wanted throughout states to sell device preventing breakage of small drills. Liberal commission. AS-645, Am. Mach.

BUSINESS OPPORTUNITIES

Partner Wanted

Partner with ten to twenty thousand dollars to take active interest and manage well established New York City machinery business where stock is carried. Present owner has other interests requiring entire time out of city. One having practical knowledge preferred, but good executive would answer; splendid opportunity for right man. BO-642, Am. Mach.

New Devices to Manufacture Wanted

As president of a progressive company, I am instructed to obtain for our manufacture new devices promising a profitable market; preferably, but not necessarily, those using grey iron castings as part of their construction. If you wish to connect with a reliable manufacturer to develop your ideas, write to W. O. Adams, Ann Arbor, Mich.

Sales Manager With Capital Wanted

Manufacturing concern wants men to open office and manage salesmen; wonderful opportunity to make big money. From $300 to $2,000 necessary. Write, Connery Machine Tool Co., Springfield, Mass.

WORK WANTED

Industrial Engineering

Special machine design, dies, fixtures, jigs, special tools, production work; furnaces and industrial engineering at reasonable prices by practical engineers. WW-653, Am. Mach., Old Colony Bldg., Chicago.

PATENT ATTORNEY

PATENTS, C. L. Parker, patent attorney, McGill Bldg., Washington, D. C. Inventor's handbook sent upon request.

MISCELLANEOUS

Build Your Own Stock Boxes

Bin label cards, sheet metal card holders, bin markers, stock record cards for mill, auto and plumbing supplies. Send for sample prices and free booklet, "How to Systematize the Stock Room and Build Your Onw Stock Boxes." Haddon Bin Label Co., Haddon Heights, N. J.

FOR SALE

Patent For Sale

Mixing valve, simple reliable design. Firm wanting stable, standardized production correspond with FS-634, Amer. Mach.

EDUCATIONAL

COURSES — $30 in mechanical drawing, steam, gas, electric engineering, shop practice, cost accounting. E. B. Wilson, Principal. Wilson's Correspondence Schools, Box 141M Scranton, Pa.

WANTED

Association or connection with party who can furnish profitable work for Modern Shop and Foundry —(100 to 150 men). Equipment suitable for medium or heavy work, such as pumps, engines, simple machine tools, conveying machinery, molding machines, paper cutters, contractors' machinery, road machinery, presses, steam shovels, etc.

Address BO519—American Machinist
Real Estate Trust Bldg., Phila., Pa.

Salesman Wanted for New York and Vicinity

By midwestern manufacturer of edge tools with national reputation. Applicants must be producers and have knowledge of edge tool business in territory mentioned. Applications for consideration must give full and complete outline of past experience, present position, references, and salary expected. Position pays straight salary and expenses.

AS656 Am. Mach.
Leader-News Bldg., Cleveland

FOR SALE

Business Opportunity

We are in position to furnish the most up-to-date Automatic Machinery and Equipment for the manufacture of Small Tools and Screws. Or Complete Drawings, Specifications, and Manufacturing Rights. Further particulars may be obtained from

J. H. WILHELM, INC.
42 West 39th Street, New York City

Established Lathe Chuck Business For Sale

Consisting of complete stock of Independent and Universal Geared Scroll Chucks, together with parts, special tools, patterns, good will and patent rights.

Will sacrifice to an extent that will interest you.

BO602—American Machinist
10th Ave. at 36th St., New York City

FOUNDRY FOR SALE, PONTIAC, MICH.

within twenty-five miles of Detroit, on good concrete road, good rail facilities. Fully equipped for aluminum, brass and bronze casting work and could readily be converted to grey iron. Fifteen thousand square feet of floor space. One-story concrete block construction built about two years ago. Four acres of land. Plant is centrally located and labor conditions are good. Will sell with or without equipment. For particulars and price, write:

DRAWER 47, SYRACUSE, N. Y.

Leo Monsheimer

Auctioneer and Appraiser
Machinery Specialist

Turn your machinery into cash.

366 Broadway, New York, N. Y.
Telephone: Franklin 4406.

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—to help you get what you want.

—to help you sell what you no longer need.

Take advantage of it — For Every Business Want

"Think SEARCHLIGHT First"

0165

CONTRACT WORK

WE ARE PREPARED TO MANUFACTURE

small machines or small machine parts, wherein accuracy and high finish are desired. Send blue prints, drawings or models, together with information as to quantity required and let us quote you.

SOUTHERN TEXTILE MACHINERY CO.
Paducah, Ky.

We specialize in the manufacture of

Dies, Jigs, Fixtures and Gauges

special machinery and tool designing. We solicit your inquiries. Send us blueprints and let us quote you.

WEBER & SCHER MFG. CO. 24 Scott St., Newark, N. J

Contract Work

Latest Production Equipment
For Parts or Complete Units

Automatic and hand screw machine, capacity ¼ to 4¼-in. Automatic chucking machines. Vertical and horizontal boring mills, Multiple, high power and sensitive drills. Vertical, circular, and horizontal milling machines. Lathes, Grinders, Gear cutting, Thread milling, Gun-drilling, Broaching, Stamping and Heat Treating.

For Quality Service and Right Prices

BREWSTER & CO., Long Island City, N. Y.

CLOCK WORKS

Our specialty department is admirably equipped to manufacture clock movements, meters, and similar small gear mechanism in any quantity. Let our clock experts co-operate with you.

LUX CLOCK MFG. CO.
Waterbury, Conn.

CASTINGS

BRASS, BRONZE AND ALUMINUM MACHINE WORK.

THE COLUMBUS BRASS COMPANY
540 DUBLIN AVE., COLUMBUS, OHIO

Dorchester Machine & Tool Works

Incorporated
70 Freeport Street, Dorchester, Boston, Mass.

Machine Designing, Special Machinery and Experimental Work

Punch and Die Work, Jigs, Fixtures and Tools

Accurate Work at Reasonable Prices

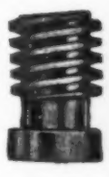
Let us bid on your blue prints, or handle your work at an hourly rate.

No Thread Milling Work Too Difficult

We have the equipment and the expert mechanics to handle your Thread Milling Work true to specifications with efficiency and dispatch.

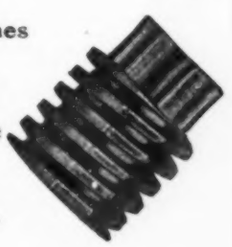
Can also assure prompt service on

Screw Machine Products
Small Machine Work
Grinding in All Its Branches



We solicit your inquiries and an opportunity to prove our work

Wicaco Screw & Machine Works, Inc.
Established 1868
N. E. Cor. Seventh and Wood Sts.
PHILADELPHIA, PA.



One Hundred Tons a Day

of high grade machinery, gray iron castings, is the capacity of the plant we place at your service. Wire, write or phone for estimates on your work.

JAMES A. BRADY FOUNDRY CO.

4508 Western Avenue, Chicago

COWDREY

CONTRACTORS, BUILDERS & DESIGNERS OF

Special Machinery of Any Nature

WHETHER you want a fine, delicate operating laboratory instrument which must be accurate to a fine dimension or a burly big machine for production work, we will make it exactly to your specification.

Full details on request

SPECIAL MACHINERY

C. H. COWDREY MACHINE WORKS 18 SUMMER STREET FITCHBURG MASS.

Parts and Complete Units

Stampings, Screw Machine Products, Assembly of Small Parts and Units.

ELECTRIC BUREAU, Inc.
88—33rd St., Brooklyn, N. Y.

Intricate Light Metal *STAMPINGS*

We also manufacture all kinds of
TOOLS, DIES, GAUGES, FIXTURES as well as
SPECIAL MACHINERY AND ARTS

BEAVER MACHINE & TOOL CO., Inc., 625-643 N. Third Street, Newark, N. J.

We Build Anything

in light and medium machinery, any quantity. Tools, Fixtures, Jigs and Dies for interchangeable production. Experimental and model work.

Berggren & Pearson Machine Co.
Incorporated
221-227 Canal Street, New York City

Machine Construction

We specialize in building all kinds of high-grade machines, tools, jigs, dies, punches, etc.

Our plant is thoroughly modern and is highly developed for reproduction work; we employ over 2,000 men and our equipment is unexcelled.

Write us for additional information.

American Machine & Foundry Company
(Contract Dept.)
552 Second Avenue, Brooklyn, N. Y., U. S. A.

SPECIAL MACHINERY
BUILT TO ORDER

We have splendid facilities for producing special machinery of all kinds, and are prepared to guarantee satisfaction—both as regards workmanship and price. We have foundry facilities and an up-to-date machine shop. Send us blue-prints and give us an opportunity to quote you price. We can save you money.

Lambert & Todd Machine Co., Camden, N. J.

PRODUCTION WORK!

We are in a position to handle any type of production or assembling work. Special Parts, Screw Machine Products, Stampings, Special Tools, Jigs, Fixtures and Special Machinery.

Workmanship Guaranteed—Prices Right
Let us give you an estimate.

THE SUMMIT MACHINE CO.
705 Summit Avenue, Jersey City, N. J.

Let us be your toolroom

Quality -- Prompt Delivery — Fair Price

Something for Nothing

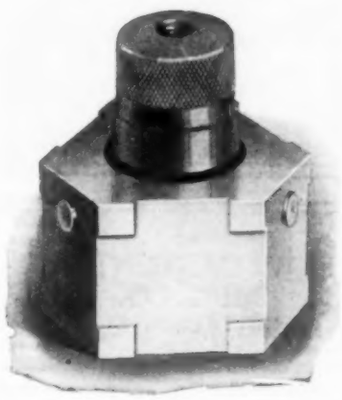
You receive *Something For Nothing* when we design and make your *tools, dies, jigs, fixtures, gauges and precision machinery,* because our billing clerk does not bill you for our experience.

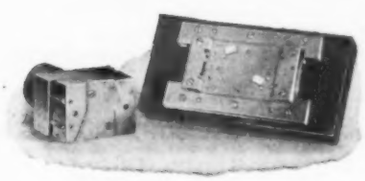
You are only paying for actual time used in making your tools and not for the hours and sometimes days we spend in solving your tool problems.

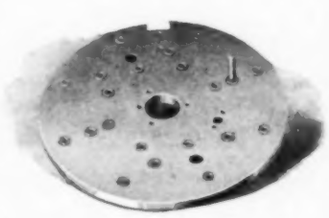
Tools designed and made by us are not only of the very best workmanship and material, but are designed

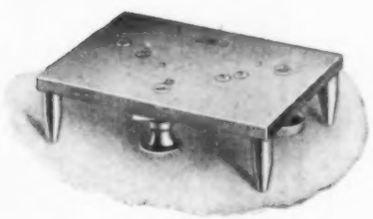
To be time saving.
To be foolproof.
To be easy and quick to handle.
To give the largest possible production.
To give absolute interchangeability.

Send us your blueprints and requirements and let us solve your tool problems.









ARTHUR BROCK, JR.,
TOOL & MFG. WORKS
533 North Eleventh Street
Philadelphia, Pa.

Machines and Parts Made Promptly and In Quantity

We are designers and builders of machinery of every description, and can guarantee either complete machines or parts being made promptly and in quantity. We have a large and completely equipped plant with every modern facility, capable of working 500 men and can handle the largest and heaviest work as well as small and medium work.

Our Engineering Department will do your designing if desired. If you have work to place and want it done well and quickly write or come and see us.

THE GENERAL ORDNANCE COMPANY, Derby, Conn.

BRASS SCREW MACHINE PRODUCTS

Ranging from ¼ in. to 2½ in. diameter. We have large and excellent facilities, and if it can possibly be made on a screw machine, we can make it. Send us your blueprints or samples and we will quote you prices.

ANSONIA MFG. CO., Ansonia, Conn., U.S.A.

INTERCHANGEABLE MACHINE PARTS

Get Our Prices

LINCOLN MACHINE CO.
PAWTUCKET, R. I.

Let Us Help You Fill Those Orders!

We are manufacturing parts and minor assemblies for other concerns who need additional production to keep pace with their orders.

Send us your blueprints or have our representative call.

FRED'K PEARCE CO.
18 Rose St. *Est. 1872* New York City

Accurate

Screw Machine Products

Prompt deliveries. Shop fully equipped with highest class new machines. Estimates cheerfully furnished.

Tock Screw Machine Products Corp.
199-203 Eighth Street, Long Island City, N. Y.

FIRST AND BEST — ACCURATE — FB — TOOLS

FROSTHOLM BROS.
Jigs, Fixtures, Gauges, Dies, Special Machines
Syracuse, N. Y.

Screw Machine Products

Work up to 2½ in. diameter can be handled with our increased facilities. Send us your specifications.

THOS. H. DALLETT CO., Philadelphia, Pa.

PARTS
MANUFACTURERS
GENERAL MACHINE WORKS
YORK, PA.

Automatic Screw Machine Products

Our complete equipment of Automatic Screw Machines of the latest types, Gridleys and National-Acmes, is adapted for work up to 1⅝ inches. We can put these machines at work immediately for you. If you want high-grade screw machine work 1⅝ inches and under and want it quickly, write or come and see us.

CAMPBELL MANUFACTURING COMPANY
OFFICE: Slater Bldg., Worcester, Mass.
FACTORY: Barre Plains, Mass.

Tools Gauges — THE — Special Cutters
E. W. CARPENTER MFG. CO.
Jigs Fixtures — Bridgeport Conn. — Special Machinery

AUTOMATIC SCREW MACHINE PRODUCTS

Anything up to 3½-in. in diameter.

J. E. POORMAN
1825 Bristol Street, Philadelphia, Pa.

E.G.MUNSON, Utica, N.Y.
GREY IRON CASTINGS
PATTERN WORK (Wood & Iron)
MACHINE WORK

The building and mounting of patterns for moulding machines a specialty.

IF IT CAN BE DONE WE CAN DO IT

IT PAYS TO MAKE GOOD TOOLS

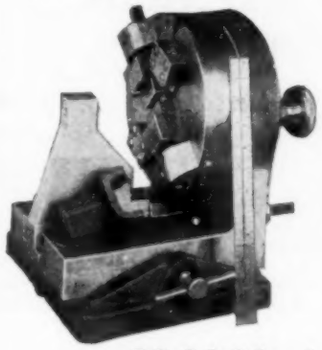
TOOLS DIES GAUGES JIGS

GEM CITY MACHINE CO.
DAYTON, OHIO.

Skillfully designed and correctly built tools

TRADE MEHL MADE MARK

IT'S the final analysis made when the tools are placed on the machines, and their subsequent performance, showing what they can do, by which you determine Whether they have been designed and built right. It is then that they show whether they are *as fast as the machines* and whether they cut non-productive motions to a minimum.



There is no doubt of the speed and motion-saving ability of Mehl-Made Tools. Mehl Tool Service is complete, both the designing and building of tools being done under one roof. Our tool prospectus will bring the plan of our service to your desk for inspection. Let us send you your copy.

Mehl Machine Tool & Die Co.
Roselle, N. J.
30 mintes from New York City

TO MEHL MACHINE TOOL & DIE CO.
Roselle, New Jersey
Send me my copy of your new tool prospectus.

Name. .....
Position. .....
Company. .....
Address. .....

TOOLS AND FIXTURES

Quick Service—Best of Workmanship—Reasonable Rates
Also Punch and Die Work

We have been doing high grade machine work for over 30 years. Our plant is completely equipped and our organization consists of experienced able men.

If you want your work done quickly and want it done well, let us hear from you.

We can refer you to many satisfied customers.

W. J. Young Machinery Co. 416 Union St. LYNN, MASS.

Over Three Thousand Special Tools Designed

during the past year for such representative firms as:

National Cash Register Co.
New Britain Machine Co.
International Motors Corp.
Carrie Gyroscopic Corp.

Our long and varied experience with tooling problems should be of value to you.

Service Engineering Co.
Incorporated
25 Church St., New York

ACCURACY EFFICIENCY

Gauges Tools Dies

ROBBINS GAMWELL & CO. PITTSFIELD, MASS.

Special Machinery

ROBBINS, GAMWELL & CO.
Pittsfield, Mass.

MACHINE SHOP WORK

Equipped for general machine shop work. Let us figure on your specifications.

Sound Machine Shop, Inc.
Mamaroneck, New York

Special Machine Work

JOBBING WORK
BY CONTRACT.

B. M. ROOT CO., YORK, PA.

We can build and assemble complete machines for you, or manufacture special parts. Our factory consists of:

Complete machine shops and tool rooms.
Sheet metal shop.
Woodworking shop.
Blacksmith shop.
Forge shop for small drop forgings.
Complete heat treating equipment.

Ask us for Quotation.
BUFFALO PITTS COMPANY, Buffalo, N. Y.

CAM CUTTING

Stampings—Screw Machine Products—Castings

Let us estimate on your requirements

HENRY M. LARSON
58 West 6th St., Mount Vernon, N. Y.

TOOLS

Special Reamers and Arbors, Boring Bars, Spot Facing Tools, Gauges, Forming Tools, High Speed or Carbon—as you like them. From our small Tools Dept. Mail that order for Tools, Dies, Jigs, Fixtures to

AMERICAN TOOL & MFG. CO.
Urbana, Ohio.

Screw Products

Service—Accuracy—Economy
¼-in to 3⅝-in.

WHITTET-HIGGINS CO.
90 Niagara Street, Providence, R. I.

CARL SCHOENERT & SONS, 631-633 S. 20th St., Newark, N.J.
Experts on
SPECIAL MACHINE TOOLS and DIES
Nothing too complicated for us.

Call on Emery

If you need special fixtures, machinery, jigs, experimental apparatus, etc. High grade workmanship guaranteed.

A. H. EMERY
Glenbrook, Conn.
Tel. Stamford, Conn.

Our Shop is at Your Service

FOR

Jigs—Fixtures—Ring, Plug and Snap Gauges—Blanking—Piercing—Drawing—Forming and Sub Press Die Work—Special Machine Work.

Send Blueprints for Estimates.

THE COLUMBUS DIE, TOOL AND MACHINE COMPANY
COLUMBUS, OHIO

FORGINGS

That save you money in machining and finishing. From a few to 10,000 pounds
Write us today.
THE JOHNSTON & JENNINGS CO.
Cleveland, Ohio, U. S. A.

This way to high-grade Gauge Work, Punches and Dies.

Accuracy!

That's what has characterized our 18 years of experience in this business. We use only the best materials.

Write for information

The Simplex Tool Co.
Woonsocket, R. I.

MACHINE WORK WANTED

FRANKLIN MACHINE CO.
Engineers, Founders and Machinists
Providence, R. I.

Iron Castings, Shafting, Hangers, Pulleys, Etc. Special Machinery, Heavy Machinery for Steel, Rubber and Paper Mills.
and

THE HARRIS-CORLISS STEAM ENGINES

We build commercially practical

TOOLS, FIXTURES, JIGS, SPECIAL MACHINERY, ETC.

At Commercial Prices.
Up-to-the-Minute Equipment

STEINER BROTHERS
Lima, Ohio

Let Us Design and Build Your
TOOLS, DIES JIGS and FIXTURES

All work guaranteed

THE BUDD-RANNEY ENGINEERING CO.
COLUMBUS, OHIO

SHEFFIELD THREAD GAUGES

For Immediate Delivery

THE SHEFFIELD MACHINE & TOOL CO.
DAYTON, OHIO

Tool Room Work of the better class

and the building of special machinery and parts is our business.

The Hartford Special Machinery Co.
Hartford, Conn.

SCREW MACHINE WORK

SPECIAL PARTS TURNED FROM BRASS, STEEL AND IRON

ERICSSON SCREW MACHINE PRODUCTS CO., INC.
607-609 BERGEN STREET, BROOKLYN, N.Y.

Gauges! Gauges! Gauges! Gauges!

Send us your orders for

Spline or Thread Gauges and Precision Taps

with ground threads
Our prices are very low.

F. Jos. Lamb Co.
402 Jefferson Ave., East
Detroit, Michigan

Gauges! Gauges! Gauges! Gauges!

THE Grant Rotary Vibrating Riveter handles the unusual and difficult work like a charm.

This remarkable riveter works just as successfully on hard steel as soft brass. Never any tool marks or bent shanks.

Handles all sizes of rivets up to ¼-in. shank—even in the hardest to reach corners.

May your New Year be Happy and Prosperous.

Write for a copy of our Booklet.

Grant Mfg. & Machine Company

85 Sillman Ave., Bridgeport, Conn.

Effective Blows on Shuster "Elastic Rotary" (Trade Mark) Blow Riveting Machines

because the power is applied directly and centrally to the hammer, and as the hammer is also rotated rapidly the rivet is turned over smoothly on all sides, and perfectly finished heads are assured.

Catalogue on request

THE F. B. SHUSTER CO., New Haven, Conn.

Formerly John Adt & Son

Established 1866

Also makers of Wire Straightening and Cutting Machinery.

DON'T FORGET

to consult the

SEARCHLIGHT SECTION

of this issue

It may hold the very opportunity for which you have been seeking

If you do not find what you want, perhaps a small ad will help you.

DISPLAYED ADS
$5 or less per inch

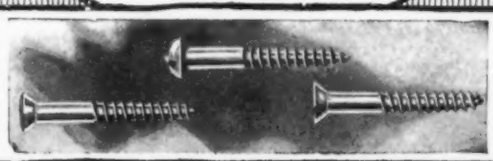
UNDISPLAYED ADS
***Positions Wanted*—8 cents a word**
***All Others*—4 cents a word**

WOOD SCREW MAKING Machinery

Ask us for catalogue Series "B-3" which will give full information concerning our complete line of Automatic Machines. Cable address: "Cook," Hartford, U. S. A. Codes:

Liebers
Western Union

Works founded in year 1858



ASA S. COOK CO.
HARTFORD, CONN.

WHAT AND WHERE TO BUY

A Classified Index of Advertisers in This Issue

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Abrasive Discs
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Carborundum Co., Niagara Falls
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Ball Retainers
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Balls, Brass, Bronze and Steel
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Barrels, Tumbling
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Bars, Boring
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S K F Industries, N. Y.
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Bunting Brass & Bronze Co., Toledo
Doehler Die Casting Co., Brooklyn.

Bearings, Die-Cast
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Franklin Die Cast. Corp., Syracuse.
Light Mfg. & Fdry. Co., Pottstown.

Bearings, Journal
Bunting Brass & Bronze Co., Toledo.
Columbus Brass Co., Columbus.
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Bearings, Roller
Gwilliam Co., N. Y.
Norma Co. of America, N. Y.
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Belt Cement
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Belt Clamps
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Belt Dressings and Fillers
Graton & Knight Mfg. Co., Worcester
Ladew Co., Edw. R., N. Y.
Schieren Co., Chas. A., N. Y.
Texas Co., N. Y
White & Bagley Co., Worcester.

Belt Fasteners
Bristol Co., Waterbury, Conn.

Belt Lacing
Chicago Rawhide Mfg. Co., Chicago.
Graton & Knight Mfg. Co., Worcester
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Belt Lacing Machines
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Belt Shifters
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Morse Chain Co., Ithaca.
Whitney Mfg. Co., Hartford.

Belting, Endless
Gilmer, L. H., Philadelphia

Belting, Leather
Chicago Rawhide Mfg. Co., Chicago.
Graton & Knight Mfg. Co., Worcester
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Schieren Co., Chas. A., N. Y.

Benches, Work
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New Britain Mach. Co., New Britain

Bench Legs
Brown & Sharpe Mfg. Co., Providence.
Manfacturing Equip. & Eng. Co., Framingham, Mass.
New Britain Mach. Co., New Britain

Bending Machines, Power
Cleveland (O.) Punch & Shear Wks.
Hilles & Jones Co., Wilmington.
Niles-Bement-Pond Co., N. Y.

Blocks
Taft-Peirce Mfg. Co., Woonsocket.

Blocks, Chain (See Hoists, Hand)
Halcomb Steel Co., Syracuse.
Camden Forge Co., Camden

Blowers
American Gas Furnace Co., N. Y.
Chicago Flexible Shaft Co., Chicago

Blue Printing Lamps
Cooper Hewitt Elect. Co., Hoboken

Blueprinting Machinery
Wickes Bros., Saginaw.

Blueprints
Wickes Bros., Saginaw, Mich.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland.
Landis Machine Co., Waynesboro.

National Machinery Co., Tiffin, O
Victor Tool Co., Waynesboro.

Bolts and Nuts
National Acme Co., Cleveland, O.

Bone for Case Hardening
Rogers & Hubbard Co., Middletown

Books, Technical
McGraw-Hill Book Co., N. Y.

Boosters
Crocker-Wheeler Co., Ampere, N. J.

Boring, Drilling and Milling Machines, Horizontal
Barnes Co., W. F. & John, Rockford
Beaman & Smith Co., Providence.
Betts Machine Co., Rochester.
Coats Mach. Tool Co., N. Y.
Gisholt Mach. Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.
Lucas Machine Tool Co., Cleveland.
Manning, Maxwell & Moore, N. Y.
Moline Tool Co., Moline, Ill.
Newton Mach. Tool Wks., Phila.
Niles-Bement-Pond Co., N. Y.
Pawling & Harnishfeger Co., Milwaukee.
Pedrick Tool & Mach. Co., Phila.
Prentiss & Co., N. Y.
Ryerson & Son, Joseph T., Chicago
Sellers & Co., Wm., Philadelphia.
Springfield Mach. Tool Co., Springfield, O.
Universal Boring Mach. Co., Hudson
Vandyck Churchill Co., N. Y.

Boring, Drilling and Milling Machines, Vertical
Baush Mch. T. Co., Springfield, Mass.
Betts Machine Co., Rochester.
Cochrane-Bly Co., Rochester.
Manning, Maxwell & Moore, N. Y.
Ryerson & Son, Joseph T., Chicago

Boring Heads
Davis Boring Tool Co., St. Louis.
Lovejoy Tool Co., Springfield, Vt.
Taft-Peirce Mfg. Co., Woonsocket.

Boring Tools
Armstrong Bros. Tool Co., Chicago.
Brown & Sharpe Mfg. Co., Providence.
Davis Boring Tool Co., St. Louis.
Independent Pneu. T. Co., Chicago.
Kelly Reamer Co., Cleveland.
Lovejoy Tool Co., Springfield, Vt.
Taft-Peirce Mfg. Co., Woonsocket.
Williams & Co., J. H., Brooklyn.

Boring and Turning Mills, Vertical
Betts Machine Co., Rochester.
Bickford & Co., H., Lakeport, N. H.
Bullard Mach. Tool Co., Bridgeport.
Cincinnati Planer Co., Cincinnati.
Colburn Mach. Tool Co., Cleveland
Gisholt Machine Co., Madison, Wis.
Manning, Maxwell & Moore, N. Y.
Newton Mach. Tool Wks., Phila.
Niles-Bement-Pond Co., N. Y.
Sellers & Co., Wm., Philadelphia.

Box Tools
Watson Mfg. Co., Toledo

Boxes, Tote (See Furniture, Machine Shop)

Broaches
Hurlbut-Rogers Broach Co., Hudson
Lapointe Co., J. N., New London.
Lapointe Mach. Tool Co., Hudson.
Taft-Peirce Mfg. Co., Woonsocket.

Broaching Machines
Lapointe Co., J. N., New London.
Lapointe Mach. Tool Co., Hudson.
Williams & Son, Ed., Jersey City

Bronze
American Bronze Corp., Berwyn, Pa.
Bunting Brass & Bronze Co., Toledo.
Lumen Bearing Co., Buffalo.

Bronze, Phosphor
Bunting Brass & Bronze Co., Toledo.

Bucket Carriers, Pivoted
Link-Belt Co., Chicago; Philadelphia

Buffing or Polishing Machines (See Polishing and Buffing Machines)

Burners, Oil and Gas
Advance Furnace & Eng. Co., Springfield, Mass.
Best, Inc., W. N., N. Y.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Johnson Gas Appliance Co., Cedar Rapids.
Tate, Jones & Co., Pittsburgh.

Bushings
American Bronze Corp., Berwyn, Pa.
Bunting Brass & Bronze Co., Toledo.
Columbus Brass Co., Columbus.
Lumen Bearing Co., Buffalo.
Sterling Specialty Co., Newcomerstown.

Cabinets, Tool
Armstrong Bros. Tool Co., Chicago.

Calipers
Athol Machine Co., Athol, Mass.
Brown & Sharpe Mfg. Co., Providence.
Horstmann Co., F. W., Irvington
Randall & Stickney, Waltham
Starrett Co., L. S., Athol, Mass.

Cam Cutting Machines
Cochrane-Bly Co., Rochester.
Garvin Mach. Co., N. Y.
Larson, Henry M., Mt Vernon
Rowbottom Mach. Co., Waterbury.
Taft-Peirce Mfg. Co., Woonsocket.

Cams
Rowbottom Machine Co., Waterbury

Can-Making Machinery (See Sheet Metal Working Machinery)

Castings, Aluminum
Acme Die Cast. Co., Brooklyn.
Bunting Brass & Bronze Co., Toledo.
Cleveland Mach. Tool Co., Cleveland
Doehler Die Casting Co., Brooklyn.
Light Mfg. & Fdry. Co., Pottstown
Stewart Mfg. Corp., Chicago.

Castings, Brass and Bronze
Accurate Brass Cast Co., Brooklyn
American Bronze Corp., Berwyn, Pa.
Bunting Brass & Bronze Co., Toledo.
Columbus Brass Co., Columbus.
Doehler Die Casting Co., Brooklyn.
Imperial Brass Mfg. Co., Chicago.
Light Mfg. & Fdry. Co., Pottstown.
Lumen Bearing Co., Buffalo.
Pangborn Corp., Hagerstown, Md.
Phosphor Bronze Smelt. Co., Phila
Stewart Mfg. Corp., Chicago.

Castings, Die Molded
Acme Die Cast. Co., Brooklyn.
Doehler Die Casting Co., Brooklyn.
Franklin Die Cast. Corp., Syracuse
Keystone Die-Casting Co., Norristown.
Light Mfg. & Fdry. Co., Pottstown
Lumen Bearing Co., Buffalo.
Stewart Mfg. Corp., Chicago.

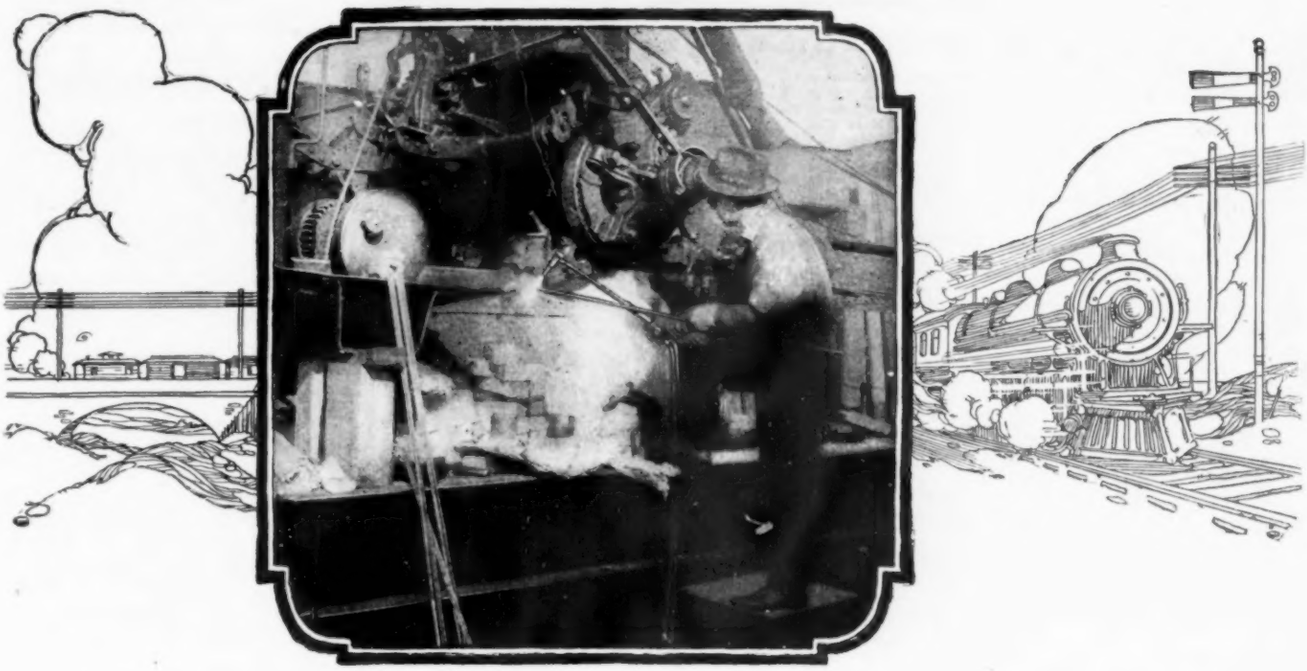
Castings, Iron
Athol Machine Co., Athol, Mass.
Birdsboro Steel F. & M. Co., Birdsboro.
Brady Fdry. Co., Jas. A., Chicago.
Brown & Sharpe Mfg. Co., Providence.
Caldwell & Son Co., H. W., Chicago
Chisholm-Moore Mfg. Co., Clevelnd
Franklin Mach. Co., Providence
Hilles & Jones Co., Wilmington, Del
Munson, E. G., Utica, N. Y.
Springfield Mach. Tool Co., Springfield, O.
Whitcomb-Blaisdell Mach. Tool Co. Worcester.

Castings, Nichrome
Driver-Harris Co., Harrison, N. J.

Castings, Semi-Steel
Hilles & Jones Co., Wilmington.
Pangborn Corp., Hagerstown, Md.
Springfield Mach. Tool Co., Springfield, O.

Casting, Steel
Ohio Steel Fdry. Co., Springfield, O

Cements, Iron
Hilo Varnish Corp., Brooklyn.
Smooth-On Mfg. Co., Jersey City.



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Whiton Mach. Co., D. E., New London

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Cincinnati Planer Co., Cincinnati.
Woodward & Powell Planer Co., Worcester.

Chains (See Sprockets and Chains)

Chains, Driving
Baldwin Chain & Mfg. Co., Worcester.
Boston Gear Wks., Norfolk Downs.
Link-Belt Co., Philadelphia; Chicago
Morse Chain Co., Ithaca, N. Y.
Whitney Mfg. Co., Hartford.

Chemists
Souther, Eng. Corp., Hy., Hartford.

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Gisholt Mach. Co., Madison, Wis.
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New Britain Mach. Co., New Britain
Potter & Johnson Mch. Co., Pawtucket.
Warner & Swasey Co., Cleveland.

Chucks, Air
Manufacturing Equip. & Eng. Co., Framingham

Chucks, Centering
Cushman Chuck Co., Hartford.
Thomas Elevator Co., Chicago
Westcott Chuck Co., Oneida, N. Y.

Chucks, Drill and Tap
Almond Mfg. Co., T. R., Ashburnham
American Mach. Co., Hartford.
Bicknell-Thomas Co., Greenfield.
Clark Equipment Co., Buchanan.
Cushman Chuck Co., Hartford.
Eastern Tube & Tool Co., Brooklyn.
Horton & Son Co., E., Windsor Locks
Jacobs Mfg. Co., Hartford.
Jarvis Co., Charles L., Gildersleeve.
Modern Tool Co., Erie, Pa.
Morse Twist D. & M. Co., New Bedford
National Twist D. & T. Co., Detroit
Scully-Jones Co., Chicago.
S K F Industries, N. Y.
Skinner Chuck Co., New Britain.
Union Mfg. Co., New Britain, Ct.
Victor Tool Co., Waynesboro, Pa.
Whitney Mfg. Co., Hartford
Whiton Mach. Co., D. E., New London

Chucks, Lathe
Almond Mfg. Co., T. R., Ashburnham
Bullard Mach. Tool Co., Bridgeport.
Frontier Chuck & Tool Co., Buffalo
Cushman Chuck Co., Hartford.
Gisholt Mach. Co., Madison, Wis.
Hoggson & Pettis Mfg. Co., New Haven.
Horton & Son Co., E., Windsor Locks
Russell, Holbrook & Henderson, N.Y.
Ryerson & Son, Joseph T., Chicago
Skinner Chuck Co., New Britain.
Thomas Elevator Co., Chicago
Union Mfg. Co., New Britain.
Whiton Mach. Co., D. E., New London.

Chucks, Magnetic
Heald Machine Co., Worcester.
Persons-Arter Mach. Co., Worcester.
Taft-Peirce Mfg. Co., Woonsocket.

Chucks, Planer
Cincinnati Planer Co., Cincinnati.
Hoggson & Pettis Mfg. Co., New Haven
Horton & Son Co., E., Windsor Locks
Skinner Chuck Co., New Britain.
Union Mfg. Co., New Britain.

Chucks, Split
Ames Co., B. C., Waltham, Mass.
Rivett Lathe & Grinder Co., Boston.
Seneca Falls Mfg. Co., Seneca Falls.
Sloan & Chace Mfg. Co., Newark.
Stark Tool Co., Waltham.
Wade-American Precision T. Co., Waltham

Chucks, Vertical Boring Mill
Bullard Mach. Tool Co., Bridgeport.
Gisholt Machine Co., Madison.

Clamps, Machinists'
Armstrong Bros. Tool Co., Chicago.
Manning, Maxwell & Moore, N. Y.
Reed Mfg. Co., Erie, Pa.
Starrett Co., L. S., Athol, Mass.
Williams & Co., J. H., Brooklyn.

Cleaners, Metal, Waste General
Oakley Chemical Co., N. Y.

Clocks, Time
Gisholt Machine Co., Madison.

Clutches, Friction
Brown Co., A. & F., N. Y.
Brown Engrg. Co., Reading, Pa.
Edgemont Mch. Co., Dayton
Hilliard Clutch & Mchry. Co., Elmira.
Johnson Mach. Co., Carlyle, Manchester.
Link-Belt Co., Chicago, Philadelphia
Moore & White Co., Philadelphia.
Oesterlein Mach. Co., Cincinnati.
Transmission Ball Bearing Co., Buffalo.

Coal and Ash Handling Machinery
Link-Belt Co., Chicago, Phila.
Shepard Elec. C. & H. Co., Montour Falls.
Whiting Corporation, Harvey

Coal-Storage Systems
Link-Belt Co., Chicago, Philadelphia

Collars, Shaft & Set
Royersford Fdry. & Mch. Co., Royersford

Collars, Spacing
Detroit Stamp. Co., Detroit.
Scully-Jones Co., Chicago.

Collets
Brown & Sharpe Mfg. Co., Providence.
McCrosky Tool Corp., Meadville Pa.
Modern Tool Co., Erie, Pa.
Rivett Lathe & Grinder Co., Boston.
Standard Eng. Wks., Pawtucket.
Union Twist Drill Co., Athol, Mass.
Whitney Mfg. Co., Hartford.

Compounds, Carburizing, Casehardening and Tempering
Bennett Co., W. R., Elmwood, Ct.
Coats Mach. Tool Co., N. Y.
Fiske Bros. Refining Co., N. Y.
Rogers & Hubbard Co., Middletown
Shore Instrument & Mfg. Co., N. Y.
Steel Treating Equip. Co., Detroit.

Compounds, Cleaning
Oakley Chemical Co., N. Y.

Compounds, Cutting, Drawing, Drilling, Grinding and Screw Cutting
Fiske Bros. Ref. Co., N. Y.
Oakley Chemical Co., N. Y.
Sun Co. Philadelphia
Texas Co., N. Y.
White & Bagley Co., Worcester.

Compounds, Pipe-Joint
Smooth-On Mfg. Co., Jersey City.

Compressors, Air and Gas
Black & Decker Mfg. Co., Baltimore
Bury Compressor Co., Erie.
Chicago Pneumatic Tool Co., N. Y.
Ingersoll-Rand Co., N. Y.
Sullivan Machinery Co., Chicago.
Worthington P. & M. Corp., N. Y.

Cones, Friction
Evans Fric. Cone Co., Newton Highlands.

Contract Work
Acklin Stamping Co., Toledo.
American Mch. & Fdry Co., B'klyn.
American Tool & Mfg. Co., Urbana.
Ames Co., B. C., Waltham
Ansonia Mfg. Co., Ansonia.
Beaver Mach. & Tool Co., Newark.
Berggren & Pearson Mch. Co., N. Y.
Betts Mach. Co., Rochester.
Bicknell-Thomas Co., Greenfield.
Boston Scale & Mach. Co., Boston.
Brady Fdry. Co., Jas. A., Chicago.
Brewster & Co., Long Island City
Brock Tool & Mfg. Wks., Phila.
Brown Eng. Co., Reading.
Budd & Ranney Engr. Co., Columbus.
Buffalo Pitts Co., Buffalo.
Campbell Mfg. Co., Worcester
Carpenter Mfg. Co., E. W., Bridgeport
Cincinnati (O.) Automatic Mch. Co.
Columbus Die T. & M. Co., Columbus
Cowdrey Mach. Wks., C. H., Fitchburg.
Dallett Co., Thos. H., Phila.
Davis-Bournonville Co., Jersey City.
Detroit Stamping Co., Detroit
Dorchester Mch. & T. Wks., Dorchester
Eastern Mch. Screw Corp., New Haven
Earle Gear & Mch. Co., Philadelphia.
Electric Bureau, Brooklyn
Emery, A. H., Glenbrook, Conn.
Ericsson Screw M. Products Co., Brooklyn
Franklin Mach. Co., Providence.
Frostholm Bros., Syracuse.
Garvin Mach. Co., N. Y.
Gem City Mach. Co., Dayton, O.
General Mach. Wks., York.
General Ordnance Co., Derby.
Gisholt Mch. Co., Madison
Grant Mfg. & Mach. Co., Bridgeport
Grover File Co., Nashua, N. H.
Hartford Special Mchy. Co., Hartford.
Horstmann Co., F. W., Irvington
Lamb Co., Jos. T., Detroit
Lambert & Todd Mach. Co., Camden.
Lincoln Mach. Co., Pawtucket.
Link-Belt Co., Chicago, Phila.
Lux Clock Mfg. Co., Waterbury
Mehl Mach. Tool & Die Co., Roselle.
Meisel Press Mfg. Co., Boston.
Moody Tool Wks., Chas. J., Elgin.
National Acme., Cleveland.
National Mach. Tool Co., Cincinnati.
Nelson T. & Mch. Co., Bloomfield
Nestor Mfg. Co., N. Y.
New Britain Mch. Co., New Britain
Pearce Co., Fred'k, N. Y.
Poorman, J. E., Philadelphia
Potter T. & M. Wks., N. Y.
Prest-O-Lite Co., N. Y.
Robbins, Gamwell & Co., Pittsfield.
Root Co., B. M., York
Rowbottom Mach. Co., N. Y.
Schoenert & Sons, Carl, Newark
Service Engrg. Co., N. Y.
Sheffield Mach. & Tool Co., Dayton.
Silvan Eng. Co., Darby
Simplex Tool Co., Woonsocket
Sloan & Chace Mfg. Co., Newark.
Slocomb Co., J. T., Providence
Sound Mach. Shop, Mamaroneck.
Southern Textile Mchy. Co., Paducah
Starrett Co., L. S., Athol
Steiner Bros., Lima
Sterling Specialty Co., Newcomerstown
Summit Mch. Co., Jersey City
Taft-Peirce Mfg. Co., Woonsocket.
Tock Screw Mch. Products Corp., L. I. City.
Underwood Corp., H. B., Phila.
Wade-American Precision Tool Co., Waltham
Waltham Mach. Wks., Waltham
Weber & Scher Mfg. Co., Newark.
Whiting & Comstock, Hartford.
Whittet-Higgins Co., Providence
Wicaco Screw & Mch. Wks., Phila.
Young Mchy. Co., W. J., Lynn.

Controllers and Starters, Electric
Crocker-Wheeler Co., Ampere.

Conveyors and Elevators (See Elevators)

Counterbores
Bennett Tool Co., Wrentham
Detroit Twist Drill Co., Detroit
National Tool Co., Cleveland
National Twist D. & T. Co., Detroit
New Britain Tool & Mfg. Co., New Britain.
Pratt & Whitney Co., Hartford.

Countershafts
Brown & Sharpe Mfg. Co., Providence.
Builders' Iron Fdry., Providence.
Diamond Mach. Co., Providence.
Evans Fric. Cone Co., Newton Highlands.
Garvin Mach. Co., N. Y.
Norton Co., Worcester

Countersinks
Bennett Tool Co., Wrentham
Clark Equip. Co., Buchanan, Mich.
Lincoln Twist Drill Co., Taunton.
Rich Tool Co., Chicago.

Counters, Revolution
Bristol Co., Waterbury.
Brown Instrument Co., Philadelphia
Durant Mfg. Co., Milwaukee

Counting Machines
Brown Instrument Co., Philadelphia
Durant Mfg. Co., Milwaukee
Hart Mfg. Co., R. A., Battle Creek.

Counting and Printing Wheels
Doehler Die Casting Co., Brooklyn.
Franklin Die Cast. Corp., Syracuse.

Couplings, Flexible
Dexter, I. H., Goshen
Smith and Serrell, Newark.

Couplings, Rigid
Smith & Serrell, N. Y.

Couplings, Shaft
Almond, T. R., Mfg. Co., Ashburnham
Dexter & Co., I. H., Goshen.
Edgemont Mch. Co., Dayton
Johnson Mach. Co., Carlyle, Manchester.
Nicholson Co., W. H., Wilkes-Barre.
Royersford Fdry. & Mach. Co., Royersford
Smith and Serrell, Newark, N. J.

Cranes, Electric
Euclid Crane & Hoist Co., Euclid
Link-Belt Co., Chicago, Philadelphia
Whiting Corporation, Harvey

Cranes, Hand (See Hoists, Hand)

Cranes, Locomotive
Link-Belt Co., Chicago, Philadelphia
Yale & Towne Mfg. Co., Stamford.

Cranes, Traveling
Canton Fdry. & Mach. Co., Canton.
Chisholm-Moore Mfg. Co., Cleveland
Euclid Crane & Hoist Co., Euclid
Fairbanks Morse Co., N. Y.
Harrington, Son & Co., Ed., Phila.
Link-Belt Co., Chicago, Philadelphia
Niles-Bement-Pond Co., N. Y.
Northern Engrg. Wks., Detroit.
Pawling & Harnischfeger Co., Milwaukee.
Shepard Elec. C. & H. Co., Montour Falls.
Whiting Corporation, Harvey
Yale & Towne Mfg. Co., Stamford.

Crank Pin Turning Machines
Niles-Bement-Pond Co., N. Y.
Underwood Corp., H. B., Phila.

Cupolas and Ladles
Paxson Co., J. W., Philadelphia.
Whiting Corporation, Harvey

Cutters, Flue
Clark Equip. Co., Buchanan, Mich.

Cutters, Gear
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence.
National Tool Co., Cleveland
National Twist D. & T. Co., Detroit
Union Twist Drill Co., Athol, Mass.

Cutters, Milling
Barber-Colman Co., Rockford, Ill.
Becker Milling Mach. Co., Hyde Park
Bilton Mach. Tool Co., Bridgeport.
Brown & Sharpe Mfg. Co., Providence.
Cowles Tool Co., Cleveland.
Detroit Twist Drill Co., Detroit
Geometric Tool Co., New Haven.
Goddard & Goddard Co., Detroit
Ingersoll Milling Mch. Co., Rockford
Lincoln Twist Drill Co., Taunton.
Lovejoy Tool Co., Springfield, Vt.
Moody Tool Wks., Chas. J. Elgin.
Morse Twist Drill & Mch. Co., New Bedford
National Tool Co., Cleveland.
National Twist D. & T. Co., Detroit
New Britain Tool & Mfg. Co., New Britain.
Pratt & Whitney Co., Hartford.
Rich Tool Co., Chicago.
Union Twist Drill Co., Athol, Mass
Whitney Mfg. Co., Hartford.

Cutters, Thread.
Rivett Lathe & Grinder Co., Boston

Cutting-Off Machines
Armstrong-Blum Mfg. Co., Chicago
Armstrong Bros. Tool Co., Chicago.
Atkins & Co., E. C., Indianapolis.
Automatic Mach. Co., Bridgeport.
Brown & Sharpe Mfg. Co., Providence.
Coats Mach. Tool Co., N. Y.
Cochrane-Bly Co., Rochester.
Curtis & Curtic Co., Bridgeport
Davis Mch. T. Co., Rochester
Earle Gear & Mach. Co., Phila.
Etna Mch. Co., Toledo
Garvin Mach. Co., N. Y.
Gorton Mach. Co., Geo., Racine.
Hurlbut-Rogers Mchy. Co., So. Sudbury
Newton Mach. Tool Wks., Phila.
Vandyck Churchill Co., N. Y.

Cutting-Off Machines, Pipe (See Pipe-Cutting and Threading Machines)

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago.
Pratt & Whitney Co., Hartford.

Cutting Oil Filters (See Oil Filtering Systems)

Cutting, Oxy-Acetylene
Davis-Bournonville Co., Jersey City.
Milburn Co., Alexander, Baltimore
Prest-O-Lite Co., N. Y.

Dealers, Machinery (See Searchlight Section)
American Mchy. Ex., N. Y.
Barbour Love & Woodward, N. Y.
Beal & Co., Joseph, Boston
Botwinik Bros., New Haven.
Brownell Mchy. Co., Providence.
Clifton-Pratt Co., Cincinnati
Crawford, F. H., N. Y.
Day Mchy. Co., Buffalo
Duff Co., J. E., N. Y.
Fairbanks Co., N. Y.
Federal Mchy. Sales Co., Chicago
Freidus & Co., B., Boston

"Automatic" Hob Thread Milling Machine

For threading or milling located at or near the ends of parts six inches or less in diameter this machine has no equal. The Head Stock holding the main spindle swivels on the bed so that taper internal or external threads can be milled the same as straight.

Eighteen years' experience in threading work has made us specialists in this line. Let us give you the benefit of our accumulated knowledge. If we haven't a stock machine to do your particular job we can build one that will.

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Bridgeport, Conn., U. S. A.

OVER-SEAS REPRESENTATIVE
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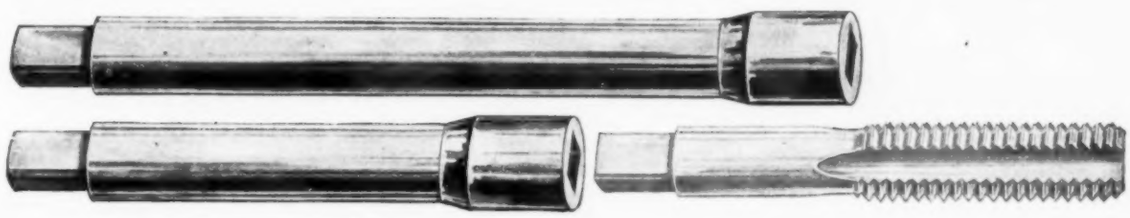

Allen Tap Extensions

—Make any tap a pulley tap

ALLEN Tap Extensions do the work of a pulley tap, with an adaptability to *any* job that no long-shank tap can possess. They cost less than pulley taps, and save the expense of replacements due to breakage of the special long shanks. Set consists of two pieces: 4 inches and 6 inches long respectively (10 inches in combination). Experience proves these lengths to be the most practical and suitable for all-round use.

The sockets are formed by the Allen process of cold-drawing, which increases the density of the steel around the socket-hole, and adds to its strength 30%. The squares and socket-openings conform to the standard used generally by leading tap manufacturers, and where some makes have shanks with squares slightly larger than this standard they may be ground to fit. List of sizes, with prices, will be sent on request; *immediate delivery if required.*

The ALLEN MFG. COMPANY, 129 Sheldon Street HARTFORD, CONN.

Exclusive Manufacturers of Safety Set Screws, Socket Head Cap Screws and Tap Extensions—Allen Process

Pacific Coast Branch Office: The Charles A. Dowd Sales Co., 320 Market St., San Francisco, Calif.

Garvin Mach. Co., N. Y.
Gelb & Co., J., N. Y.
Graves Mchy. Exchange, N. Y.
Hannan-Finton Co., Springfield.
Harris Bros. Co., Chicago
Hess Schenck Co., Cleveland
Hill, Clarke & Co., Boston.
Hill, Clarke & Co. of Chicago.
Ideal Mchy. Co., Plainsville
Industrial Mchy. Corp., Jersey City
Lamberg & Co., A., N. Y.
Lucas & Son, J. L., Bridgeport
Lynd-Farquhar Co., Boston.
McCoy Brandt Mchy. Co., Pittsburgh
McMullen Mchy. Co., Grand Rapids
Machine Tool Eng. Co., N. Y.
Manning, Maxwell & Moore, N. Y.
Marshall & Huschart Mchy. Co., Chicago.
Morey & Co., N. Y.
Morris Mchy. Co., Newark
Motch & Merryweather Mchy. Co., Cleveland.
National Pipe & Supply Co., Philadelphia.
Nemirovsky & Son, S., Philadelphia
N. Y. Mchy. Ex., N. Y.
Niles & Co., F. H., N. Y.
Niles-Bement-Pond Co., N. Y.
Osborne & Sexton Mchy. Co., Columbus.
Peninsular Mchy. Ex., Detroit.
Prentiss & Co., Henry, N. Y.
Richmond Forgings Corp., Richmond
Rothschild, R., Brooklyn
Russell Mch. Co., Pittsburgh
Ryerson & Son, Joseph T., Chicago
Savage, W. H., Fitchburg, Mass.
Schoonmaker & Sons., A. G., N. Y.
Simmons Mach. Co., N. Y.
Standard Machy. Co., New Haven
Stickley Mach. Co., Detroit.
Stocker-Rumely-Wachs, Chicago
Strong, Carlisle & Hammond Co., Cleveland
Swind Mchy. Co., Philadelphia
Toomey, Frank, Philadelphia.
Vandyck Churchill Co., N. Y.
Vonnegut Mchy. Co., Indianapolis.
Walsh Mchy. Co., M. J., Milwaukee.
Warner Co., H. D., Hartford.
Wayne Mchy. Co., Ft. Wayne.
Winterer, H. L., Philadelphia.

Diamond Tools

Crafts & Co., Arthur A., Boston.
Dickinson, Thomas L., N. Y.
Joyce-Koebel Co., N. Y.
Rose Co., S., N. Y.
Wheel Trueing Tool Co., Detroit.

Die Making Machines

Cochrane-Bly Co., Rochester.
Fairbanks-Morse, N. Y.
Keller Mech. Engraving Co., Bklyn.

Dies, Forging

Keller Mech. Engraving Co., Bklyn.

Dies, Self-Opening Adjustable

Eastern Mach. S. Corp., New Haven.
Geometric Tool Co., New Haven
Murchey Mch. & Tool Co., Detroit

Dies, Sheet Metal and Sub-Press (See Tool Work)

Dies, Threading-Opening

Eastern Mach. S. Corp., New Haven.
Errington Mechanical Laboratory, N. Y.
Geometric Tool Co., New Haven.
Ideal Tool & Mfg. Co., Beaver Falls.
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Mach. Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Mach. & Tool Co., Detroit.
National Acme Co., Cleveland.
National Mchy. Co., Tiffin, Ohio.
Rickert-Shafer Co., Erie, Pa.
Warner & Swasey Co., Cleveland.

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New Britain Tool & Mfg. Co., New Britain.
Whiting & Comstock, Hartford.

Dogs, Lathe and Milling Machine

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Williams & Co., J. H., Brooklyn.

Drafting Boards and Tables

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Universal Drafting Mch. Co., Cleveland

Drafting Materials

Spaulding-Moss Co., Boston.
Universal Drafting Mch. Co., Cleveland

Dressers, Grinding Wheel

Bay State Stamping Co., Worcester.
Crafts & Co., Arthur A., Boston.
H. P. Company, Midland, Mich.
Norton Co., Worcester
Ross Mfg. Co., Cleveland

Drill Holders

Armstrong Bros. Tool Co., Chicago.

Drill Speeders

Graham Mfg. Co., Providence.
Turner Mach. Co., Danbury.

Drilling Attachments

Hjorth Lathe & T. Co., Boston.

Drilling Machine Heads

Baush Mch. T. Co., Springfield, Mass.
Langelier Mfg. Co., Arlington, R.I.
Nelson-Blanck Mfg. Co., Detroit.

Drilling Machines, Automatic

Avey Drilling Mach. Co., Cincinnati.
Baker Bros., Toledo, O.
Baush Mch. T. Co., Springfield, Mass.
Bilton Mach. Tool Co., Bridgeport.
Langelier Mfg. Co., Arlington, R. I.
National Auto. Tool Co., Richmond.
Russell, Holbrook & Henderson, N.Y.

Drilling Machines, Bench

Ames Co., B. C., Waltham, Mass.
Avey Drill. Mach. Co., Cincinnati.
Barnes Co., W. F. & John, Rockford.
Bilton Mach. Tool Co., Bridgeport.
Clark Elect. Co., Jas., Louisville.
Langelier Mfg. Co., Arlington, R. I.
Pratt & Whitney Co., Hartford.
Silver Mfg. Co., Salem
Sloan & Chace Mfg. Co., Newark.
Taylor & Fenn Co., Hartford.

Drilling Machines, Electric and Pneumatic

Black & Decker Mfg. Co., Baltimore
Chicago Pneumatic Tool Co., N. Y.
Cincinnati (O.) Electric Tool Co.
Clark Elect. Co., Jas., Louisville.
Independent Pneu. Tool Co., Chicago
Ingersoll-Rand Co., N. Y.
Neil & Smith Elec. Tool Co., Cincinnati.
Silver Mfg. Co., Salem
U. S. Elec. Tool Co., Cincinnati.
Wisconsin Elec. Co., Racine.

Drilling Machines Gang

Baker Bros., Toledo.
Barnes Drill Co., Rockford, Ill.
Bilton Mach. Tool Co., Bridgeport.
Cincinnati (O.) Bickford T. Co.
Colburn Mach. Tool Co., Cleveland
Fosdick Mch. T. Co., Cincinnati
Langelier Mfg. Co., Arlington, R. I.
Moline Tool Co., Moline, Ill.
Silver Mfg. Co., Salem
Sipp Mach. Co., Paterson.
Taylor & Fenn Co., Hartford.

Drilling Machines, Heavy Duty

Baker Bros., Toledo.
Betts Mach. Co., Rochester.
Colburn Mach. Tool Co., Cleveland
Fosdick Mch. T. Co., Cincinnati
Niles-Bement-Pond Co., N. Y.
Ryerson & Son, Joseph T., Chicago

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)

Drilling Machines, Multiple Spindle

Baush Mch. T. Co., Springfield, Mass.
Fox Machine Co., Jackson, Mich.
Garrison Mch. Wks., Dayton
Harrington Son & Co., Ed., Phila.
Langelier Mfg. Co., Arlington, R. I.
National Acme Co., Cleveland
National Auto. Tool Co., Richmond.
Newton Mach. Tool Wks., Phila.
Sellers & Co., Wm., Philadelphia.
Turner Machine Co., Danbury.

Drilling Machines, Radial

American Tool Wks. Co., Cincinnati
Baush Mch. T. Co., Springfield, Mass.
Betts Mach. Co., Rochester.
Carlton Mach. Tool Co., Cincinnati.
Cincinnati (O.) Bickford Tool Co.
Cleveland (O.) Punch & S. Works.
Dreses Mach. Tool Co., Cincinnati.
Fosdick Mach. Tool Co., Cincinnati.
Hammond Mfg. Co., Cleveland.
Harrington Son & Co., Ed., Phila.
Lynd-Farquhar Co., Boston.
Morris Mach. Tool Co., Cincinnati.
Mueller Mach. Tool Co., Cincinnati.
Newton Mach. Tool Wks., Phila.
Niles-Bement-Pond Co., N. Y.
Reed-Prentice Co., Worcester.
Ryerson & Son, Joseph T., Chicago
Sellers & Co., Wm., Philadelphia.
Strong, Carlisle & Hammond Co., Cleveland.
Western Mch. T. Wks., Holland

Drilling Machines, Sensitive

Avey Drill. Mach. Co., Cincinnati.
Bilton Mach. Tool Co., Bridgeport.
Henry & Wright Mfg. Co., Hartford
Knight Mchy. Co., W. B., St. Louis.
Langelier Mfg. Co., Arlington, R. I.
Leland-Gifford Co., Worcester.
Reed-Prentice Co., Worcester.
Royersford Fdry. & Mach. Co., Royersford
Sipp Mach. Co., Paterson.
Taylor & Fenn Co., Hartford.
Wisconsin Electric Co., Racine.

Drilling Machines, Turret

National Auto. Tool Co., Richmond.
Turner Mach. Co., Danbury.

Drilling Machines, Vertical

Avey Drill. Mach. Co., Cincinnati.
Baker Bros., Toledo.
Barnes Co., W. F. & John, Rockford.
Barnes Drill Co., Inc., Rockford, Ill.
Baush Mch. T. Co., Springfield, Mass.
Betts Mach. Co., Rochester.
Cincinnati (O.) Bickford T. Co.
Colburn Mach. Tool Co., Cleveland
Davis Mach. T. Co., Rochester
Fosdick Mch. T. Co., Cincinnati
Harrington Son & Co., Ed., Phila.
Knight Mchy. Co., W. B., St. Louis.
Langelier Mfg. Co., Arlington, R. I.
Leland-Gifford Co., Worcester.
Niles-Bement-Pond Co., N. Y.
Reed-Prentice Co., Worcester.
Royersford Fdry. & Mach. Co., Royersford
Russell, Holbrook & Henderson, N.Y.
Silver Mfg. Co., Salem
Taylor & Fenn Co., Hartford.
Turner Mach. Co., Danbury.

Drills, Center

Detroit Twist Drill Co., Detroit
Morse Twist D. & M. Co., New Bedford.
National Twist D. & T. Co., Detroit
Pratt & Whitney Co., Hartford.
Lincoln Twist Drill Co., Taunton.
Union Twist Drill Co., Athol, Mass.

Drills, Ratchet

Detroit Twist Drill Co., Detroit
Lincoln Twist Drill Co., Taunton.
National Twist D. & T. Co., Detroit
Union Twist Drill Co., Athol, Mass.

Drills, Twist and Flat

Buckeye Twist Drill Co., Alliance.
Clark Equip. Co., Buchanan, Mich.
Detroit Twist Drill Co., Detroit
Fast-Feed Drill & T. Corp., Toledo
Latrobe Tool Co., Latrobe, Pa.
Lincoln Twist Drill Co., Taunton.
Morse Twist D. & M. Co., New Bedford.
National Twist D. & T. Co., Detroit
Pratt & Whitney Co., Hartford.
Rich Tool Co., Chicago.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes Mfg. Co., Akron

Electrical Instruments

Brown Instrument Co., Philadelphia

Electrical Supplies

Weston Elect. Instrument Co., Newark

Elevating Trucks (See Trucks)

Elevators and Conveyors

Caldwell & Son Co., H. W., Chicago
Link-Belt Co., Chicago, Philadelphia
Pangborn Corp., Hagerstown, Md.

Emery Wheels (See Grinding Wheels)

Enamels, Machinery

Hilo Varnish Corp., Brooklyn.

Engines, Oil

Worthington P. & M. Corp. N. Y.

Engineers, Industrial & Mechanical

Hartford Special Mchy. Co., Hartford
Service Engrg. Co., N. Y.
Souther Eng. Corp., Hartford.
Taft-Peirce Mfg. Co., Woonsocket.
Underwood Corp., H. B., Phila.

Engraving Machinery

Engravers & Printers Mach. Co., Sag Harbor.
Gorton Mach. Co., Geo., Racine.
Keller Mech. Engraving Co., Bklyn.

Expanders, Tube

Watson-Stillman Co., N. Y.

Eyeglasses, Safety (See Goggles, Safety)

Fans, Electric

Crocker-Wheeler Co., Ampere, N. J.

Fibre

Wilmington Fibre Specialty Co., Wilmington.

File Handles

Grover File Co., Nashau, N. H.
Nicholson File Co., Providence.

Files and Rasps

American Swiss F. & T. Co., N. Y.
Barnett Co., G. & H., Philadelphia
Grover File Co., Nashau, N. H.
Nicholson File Co., Providence.
Vixen Tool Co., Newark.

Filing Machines

Ames Co., B. C., Waltham, Mass.
Cochrane-Bly Co., Rochester.
Noble & Westbrook Mfg. Co., Hartford.
Oliver Instrument Co., Adrian.

Filler, Iron (See Cements, Iron)

Fittings, Hydraulic

Elmes Eng. Wks., Chas. P., Chicago
Watson-Stillman Co., N. Y.

Flexible Shafts

Chicago Flexible Shaft Co., Chicago
Errington Mechanical Laboratory, N. Y.
Gem Mfg. Co., Pittsburgh.
Strand & Co., N. A., Chicago.

Flooring Wood Block

Republic Creosoting Co., Indianapolis

Forging Machinery

Acme Mchy. Co., Cleveland.
Bradley & Son, C. C., Syracuse.
National Mchy. Co., Tiffin.

Forgings, Drop

Bearings Co. of America, Lancaster.
Johnston & Jennings Co., Cleveland.
Williams Co., J. H., Brooklyn

Forgings, Hammer

Halcomb Steel Co., Syracuse
Johnston & Jennings Co., Cleveland
Williams & Co., J. H., Brooklyn

Foundry Equipment

Adams Co., Dubuque, Ia.
Anderson Bros. Mfg. Co., Rockford.
Atkins & Co., E. C., Indianapolis
Whiting Corporation, Harvey

Foundry Supplies

Paxson Co., J. W., Philadelphia

Fuel Oil Buring System

Advance Furnace & Eng. Co., Springfield, Mass.

Furnaces, Heat-Treating, Coal

American Incandescent Heat Co., Boston
Industrial Furnace Corp., Boston

Furnaces, Heat Treating, Oil and Gas

Advance Furnace & Eng. Co., Springfield, Mass.
American Gas Furnace Co., N. Y.
American Incandescent Heat Co., Boston
Bennett Co., W. R., Elmwood, Conn.
Brown & Sharpe Mfg. Co., Providence
Chicago Flexible Shaft Co., Chicago
Gilbert & Barker Mfg. Co., Springfield, Mass.
Industrial Furnace Corp., Boston
Johnson Gas Appliance Co., Cedar Rapids
Strong, Carlisle & Hammond Co., Cleveland
Tate, Jones & Co., Pittsburgh

Furnaces and Ovens, Electric

Brown Instrument Co., Philadelphia.
Englehard, Charles, N. Y.

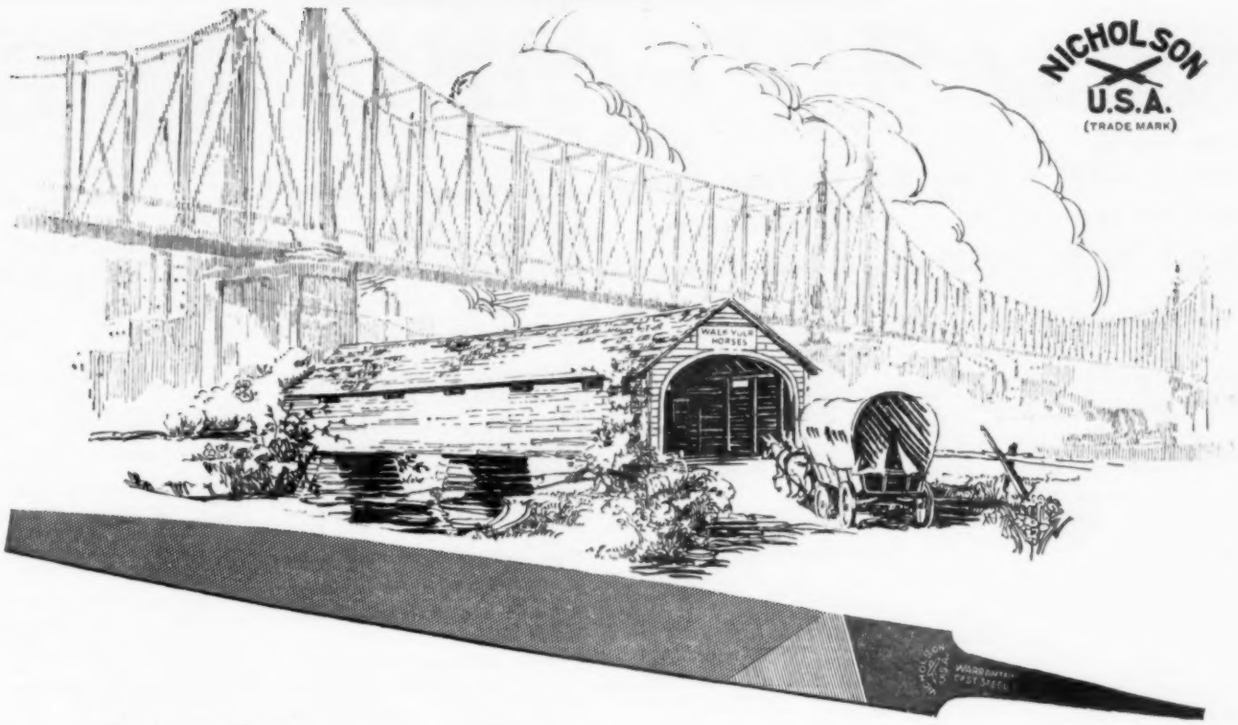
Furnaces, Tempering and Annealing

Advance Furnace & Eng. Co., Springfield, Mass.
Bennett Co., W. R., Elmwood, Ct.
Chicago Flexible Shaft Co., Chicago
Gilbert & Barker Mfg. Co., Springfield, Mass.
Johnson Gas Appliance Co., Cedar Rapids
Strong, Carlisle & Hammond Co., Cleveland
Tate, Jones & Co., Pittsburgh
Furniture, Machine Shop

Angle Steel Stool Co., Otsego.
Brown Eng. Co., Reading
Brown & Sharpe Mfg. Co., Providence
Manufacturing Equip. & Eng. Co., Framingham.
New Britain Machine Co., New Britain
Niles-Bement-Pond Co., N. Y.

Gages, Comparator

Jones & Lamson Mch. Co., Springfield, Vt.



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NICHOLSON FILE CO.
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Randall & Stickney, Waltham
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury
Brown Instrument Co., Philadelphia.

Gages, Snap, Thread and Cylindrical
Brown & Sharpe Mfg. Co., Providence
Johansson, C. E., Poughkeepsie.
Phoenix Gage Co., Phoenix, N. Y.
Sheffield Mach. & Tool Co., Dayton
Taft-Peirce Mfg. Co., Woonsocket.

Gages, Standard
Brown & Sharpe Mfg. Co., Providence
Bicknell-Thomas Co., Greenfield.
Coats Mach. Tool Co., N. Y.
Hartford Special Mchy. Co., Hartford
Johansson, C. E., Poughkeepsie.
West & Dodge Co., Boston

Galvanizing Outfits, Electro
Cutter & Wood Supply Co., Boston

Gas, Compressed
Davis-Bournonville Co., Jersey City
Prest-O-Lite Co., N. Y.

Gaskets
Graton & Knight Mfg. Co., Worcester

Gear Blanks
Johnston & Jennings Co., Cleveland

Gear Cutting Machines
Adams Co., Dubuque.
Barber-Coleman Co., Rockford, Ill.
Becker Milling Mch. Co., Hyde Park.
Bilgram Machine Works, Phila.
Bilton Mach. Tool Co., Bridgeport.
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Gear Cutting Mch. Co
Fellows Gear Shaper Co., Springfield, Vt.
Flather & Co., Nashua
Garvin Mach. Co., N. Y.
Gleason Works, Rochester
Gould & Eberhardt, Newark, N. J.
Harrington Son & Co., Phila.
Lees-Bradner Co., Cleveland
Newark Gear Cutting M. Co., Newark
Newton Mach. Tool Works, Phila.
Pratt & Whitney Co., Hartford
Preci sa & Co., Henry, N. Y.
Sloan & Chace Mfg. Co., Newark
Strong, Carlisle & Hammond Co., Cleveland
Waltham Mach. Wks., Waltham
Whiting & Comstock, Hartford
Whiton Mch. Co., D. E., New London

Gear Tempering Machinery
Gleason Works, Rochester

Gear Testing Machinery
Adams Co., Dubuque
Brown & Sharpe Mfg. Co., Providence
Gisholt Machine Co., Madison, Wis.
Gleason Works, Rochester

Gears, Cast
Brown & Sharpe Mfg. Co., Providence
Brown Co., A. & F., N. Y.
Caldwell & Son Co., H. W., Chicago
Cleveland (O) Worm Gear Co.
Franklin Die Cast Corp., Syracuse
Grant Gear Works, Inc., Boston
Horsburgh & Scott Co., Cleveland
Jones Fdry. & Mch. Co., W. A., Chicago
Link-Belt Co., Chicago, Philadelphia
Meisel Press Mfg. Co., Boston
Modern Tool & Stamp Co., Chicago
Philadelphia Gear Works, Phila.

Gears, Cut
Adams Co., Dubuque
Akron Gear & Eng. Co., Akron
Albaugh-Dover Co., Chicago
Baush Mch. T. Co., Springfield, Mass.
Bilgram Machine Works, Phila.
Boston Gear Wks., Quincy, Mass.
Brown & Sharpe Mfg. Co., Providence
Brown Co., A. & F., N. Y.
Chicago Rawhide Mfg. Co., Chicago
Cincinnati Gear Co., Cincinnati
Cleveland (O) Worm Gear Co.
Crofoot Gear Wks., Cambridge.
Diefendorf Gear Corp., Syracuse.
Earle Gear & Mch. Co., Philadelphia
Fawcus Machine Co., Pittsburgh.
Fellows Gear Shaper Co., Springfield, Vt.
Flather & Co., Nashua
Foote Bros. Gear & M. Co., Chicago.
Ganschow Co. Wm., Chicago, Ill.
Garvin Mach. Co., N. Y
Gleason Works, Rochester
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston.
Horsburgh & Scott Co., Cleveland
Jones Fdry. & Mch. Co., W. A., Chicago
Lees-Bradner Co., Cleveland
Link-Belt Co., Chicago, Philadelphia
M-C Mfg. Co., Newark, N. J.
Meacham Gear Corp., Syracuse
Meisel Press Mfg. Co., Boston
Modern Tool & Stamp Co., Chicago
Newark Gear Cutting Mach. Co., Newark.
New Britain Mach. Co., New Britain
Philadelphia Gear Works, Phila.
Pullman Ventilator Mfg. Co., York
Sier-Bath Co., N. Y.
Simonds Mfg. Co., Pittsburgh
Taft-Peirce Mfg. Co., Woonsocket.

Gears, Forged
Machinery Forging Co., Cleveland

Generators, Electric
Crocker-Wheeler Co., Ampere, N. J.
Reliance Elec. & Eng. Co., Cleveland

Goggles, Safety
King Optical Co., Julius, N. Y.

Grab Buckets
Link-Belt Co., Chicago, Philadelphia

Greases, Lubricating
Fiske Bros. Ref. Co., N. Y.
Royersford Fdry. & Mach. Co., Royersford
Sun Co., Philadelphia
Texas Co., N. Y.
White & Bagley Co., Worcester

Grinding Machines, Ball Bearing Race (See Grinding Machines, Radial)

Grinding Machines, Bench
Athol Mach. Co., Athol
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence
Clark Elec. Co., Jas., Louisville.
Diamond Mach. Co., Providence
Forbes & Myers, Worcester
New Britain Mach. Co., New Britain
Norton Co., Worcester
Precision & T. G. Mfg. Co., Phila.
Ransom Mfg. Co., Oshkosh, Wis.
Safety Emery Wheel Co., Springfield, O.
Union Twist Drill Co., Athol
U. S. Electrical Tool Co., Cincinnati

Grinding Machines, Center
Cincinnati Elec. Tool Co., Cincinnati
Gem Mfg. Co., Pittsburgh

Grinding Machines, Chaser
Geometric Tool Co., New Haven
National Acme Co., Cleveland

Grinding Machines, Chucking
Blanchard Mach. Co., Cambridge
Bryant Chucking Grinder Co., Springfield, Vt.
Churchill, Morgan, Crittsinger, Worcester
Fraser Co., Warren F., Westboro.
Heald Machine Co., Worcester
Landis Tool Co., Waynesboro
Pratt & Whitney Co., Hartford
Rivett Lathe & Grinder Co., Boston
Van Norman Mach. Tool Co., Springfield, Mass.

Grinding Machines, Cutter and Reamer
Armstrong Bros. Tool Co., Chicago
Barnes, William O., Leominster.
Barnes Co., W. F. & John, Rockford.
Blount Co., J. G., Everett
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Gear Cut, Mch. Co.
Cincinnati (O.) Milling Mach. Co.
Diamond Mach. Co., Providence
Fraser Co., Warren F., Westboro.
Garvin Mach. Co., N. Y.
Gisholt Mach. Co., Madison, Wis.
Gould & Eberhardt, Newark, N. J.
Grand Rapids (Mich.) Grind. M. Co.
Greenfield Mach. Co., Greenfield
Heald Mach. Co., Worcester
Ingersoll Milling M. Co., Rockford.
Landis Tool Co., Waynesboro
LeBlond Mach. Tool Co., R. K., Cincinnati
Manning, Maxwell & Moore, N. Y.
Modern Tool Co., Erie, Pa.
Noble & Westbrook Mfg. Co., Hartford
Norton Co., Worcester
Oakley Mach. Tool Co., Cincinnati
Oesterlein Mach. Co., Cincinnati
Ott Grinder Co., Indianapolis
Pratt & Whitney Co., Hartford
Precision & T. G. Mfg. Co., Phila.
Russell, Holbrook & Henderson, N.Y.
Safety Emery Wheel Co., Springfield, O.
Sellers & Co., Wm., Philadelphia
Sterling Grind. Wheel Co., Tiffin
Taylor & Fenn Co., Hartford
Union Twist Drill Co., Athol
U. S. Electrical Tool Co., Cincinnati
Universal Grind. Mach. Co., Fitchburg
Wilmarth & Morman Co., Grand Rapids
Woods Engineering Co., Alliance, O.

Grinding Machines, Cylindrical
Brown & Sharpe Mfg. Co., Providence
Bryant Chuck. Grinder Co., Springfield, Vt.
Cincinnati Grinder Co., Cincinnati
Detroit Mch. Tool Co., Detroit
Fitchburg Grind. Mch. Co., Fitchburg
Fraser Co., Warren F., Westboro.
Greenfield Machine Co., Greenfield
Heald Machine Co., Worcester
Landis Tool Co., Waynesboro, Pa.
Madison Mch. T. Co., Madison.
Manning, Maxwell & Moore, N. Y.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester
Oesterlein Mach. Co., Cincinnati
Ott Grinder Co., Indianapolis
Pratt & Whitney Co., Hartford
Precision & T. G. Mfg. Co., Phila.
Rivett Lathe & Grinder Co., Boston
Russell, Holbrook & Henderson, N.Y.
Taft-Peirce Mfg. Co., Woonsocket
Universal Grind. Mach. Co., Fitchburg.
Van Norman Mch. Tool Co., Springfield.
Whitney & Son, Baxter D., Winchendon.
Wilmarth & Morman Co., Grand Rapids

Grinding Machines, Die
Abrasive Mach. Tool Co., East Providence
Bignall & Keeler Mach. Co., Edwardsville.
Blanchard Mach. Co., Cambridge
Diamond Mach. Co., Providence
Fraser Co., Warren F., Westboro.
Geometric Tool Co., New Haven
Heald Machine Co., Worcester
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland.
National Mach. Co., Tiffin, O.
Newton Mach. Tool Wks., Phila.
Noble & Westbrook Mfg. Co., Hartford
Precision & T. G. Mfg. Co., Phila.
Wilmarth & Morman Co., Grand Rapids.

Grinding Machines, Disc
Badger Tool Co., Beloit
Diamond Mach. Co., Providence
Gardner Mach. Co., Beloit
Rowbottom Mach. Co., Waterbury

Grinding Machines, Drill
Grand Rapids (Mich.) Grind. M. Co.
Safety Emery Wheel Co., Springfield, O.
Sellers & Co., Wm., Philadelphia
Sterling Grind. Wheel Co., Tiffin, O.
U. S. Electrical Tool Co., Cincinnati
Wilmarth & Morman Co., Grand Rapids

Grinding Machines, Face
Blanchard Mach. Co., Cambridge
Detroit Mch. Tool Co., Detroit
Diamond Mach. Co., Providence
Persons-Arter Mach. Co., Worcester
Grinding Machines, Floor
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence
Detroit Mch. Tool Co., Detroit
Diamond Mach. Co., Providence
Forbes & Myers, Worcester
New Britain Mach. Co., New Britain
Norton Co., Worcester
Noble & Westbrook Mfg. Co., Hartford
Ransom Mfg. Co., Oshkosh, Wis.
Royersford Fdry. & Mach. Co., Royersford
Safety Emery Wheel Co., Springfield.
Sterling Grind. Wheel Co., Tiffin, O.
Wilmarth & Morman Co., Grand Rapids

Grinding Machines, Gage
Abrasive Mach. Tool Co., East Providence
Fraser Co., Warren F., Westboro.
Landis Tool Co., Waynesboro, Pa.
Ott Grinder Co., Indianapolis
Precision & T. G. Mfg. Co., Phila.
Rivett Lathe & Grinder Co., Boston
Wilmarth & Morman Co., Grand Rapids

Grinding Machines, Internal
Bryant Chuck. Grinder Co., Springfield, Vt.
Churchill, Morgan, Crittsinger, Worcester
Fraser Co., Warren F., Westboro.
Garvin Mach. Co., N. Y
Greenfield Mach. Co., Greenfield
Heald Mach. Co., Worcester
Landis Tool Co, Waynesboro
Ott Grinder Co., Indianapolis
Pratt & Whitney Co., Hartford
Rivett Lathe & Grinder Co., Boston
Taft-Peirce Mfg. Co., Woonsocket
Universal Grind. Mch. Co., Fitchburg.
Van Norman Mch. Tool Co., Springfield
Whitney & Son, Baxter D., Winchendon
Wilmarth & Morman Co., Grand Rapids

Grinding Machines, Portable
Armstrong-Blum Mfg. Co., Chicago
Black & Decker Mfg. Co., Baltimore
Chicago Pneumatic Tool Co., N. Y.
Cincinnati (O.) Electrical Tool Co
Clark Elec. Co., Jas., Louisville.
Cleveland (O.) Pneu. Tool Co.
Gem Mfg. Co., Pittsburgh
Independent Pneu. Tool Co., Chicago
Neil & Smith Elec. T. Co. Cincinnati
Precision & T. G. Mfg. Co., Phila.
U. S. Electrical Tool Co., Cincinnati
Wisconsin Electric Co., Racine

Grinding Machines, Radial
Landis Tool Co., Waynesboro
Rivett Lathe & Grinder Co., Boston

Grinding Machines, Ring Wheel
Badger Tool Co., Beloit
Diamond Mach. Co., Providence
Gardner Mach. Co., Beloit

Grinding Machines, Snagging
Blount Co., J. G., Everett
Diamond Mach. Co., Providence
Ransom Mfg. Co., Oshkosh, Wis.

Grinding Machines, Surface
Abrasive Mach. Tool Co., East Providence
Blanchard Mach. Co., Cambridge
Brown & Sharpe Mfg. Co., Providence
Detroit Mch. Tool Co., Detroit
Diamond Mach. Co., Providence
Fraser Co., Warren F., Westboro
Heald Mach. Co., Worcester
Manning, Maxwell & Moore, N. Y
Newton Mach. Tool Wks., Phila.
Noble & Westbrook Mfg. Co., Hartford
Persons-Arter Mach. Co., Worcester
Pratt & Whitney Co., Hartford
Rowbottom Mach. Co., Waterbury
Safety Emery Wheel Co., Springfield, O.
Taft-Peirce Mfg. Co., Woonsocket
Universal Grind. Mch. Co., Fitchburg.
Wilmarth & Morman Co., Grand Rapids

Grinding Machines, Universal
Brown & Sharpe Mfg. Co., Providence
Chicago Pneumatic Tool Co., N. Y.
Cincinnati (O) Grinder Co.
Fraser Co., Warren F., Westboro
Gisholt Mch. Co., Madison
Grand Rapids (Mich.) Grind. M. Co.
Greenfield Mach. Co, Greenfield
Independent Pneu. Tool Co., Chicago
Landis Tool Co., Waynesboro
Ott Grinder Co., Indianapolis
Russell, Holbrook & Henderson, N.Y
Taft-Pierce Mfg. Co., Woonsocket
Universal Grind. Mch. Co., Fitchburg.
Wilmarth & Morman Co., Grand Rapids
Woods Engineering Co., Alliance, O

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Carborundum Co., Niagara Falls
Cutter & Wood Supply Co., Boston
Dickinson, Thomas L., N. Y.
Hampden Corundum Wheel Co., Springfield.
Norton Co., Worcester
Safety Emery Wheel Co., Springfield.
Sterling Grind. Wheel Co., Tiffin.
Superior Corundum Wheel Co., Waltham.
Vitrified Co., Westfield, Mass.

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Baush Mch. T. Co., Springfield, Mass.
Pratt & Whitney Co., Hartford, Ct.
Sloan & Chase Mfg. Co., Newark

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Langelier Mfg. Co., Arlington, R. I.

Hammers, Drop
Bradley & Son, C. C., Syracuse
Niles-Bement-Pond Co., N. Y.

Hammers, Electric
Beaudry & Co., Boston
Ingersoll-Rand Co., N. Y.
Nazel Eng. & Mach. Works, Phila.

Hammers, Pneumatic
Chicago Pneu. Tool Co., N. Y.
Cleveland (O.) Pneu. Tool Co.
Independent Pneu. Tool Co., Chicago

THE GARVIN PAGE

Issued by

THE GARVIN MACHINE CO.

Builders of Machine Tools since 1865

Had a letter—

From a man down in Texas. Wanted some spare parts for a No. 14 Garvin Plain Miller.

We had to ask its serial number—and come to find out it was No. 116 shipped way back in 1901. Nineteen years' service ought to earn a machine an overhauling, so we'd say.

Mr. Down-in-Texas had some nice things to say, among them this: "* * * * * it is built to do the work; and the operator is not forgotten—he can get all around and don't have to have field glasses to see the work. He can stand close to the machine—all controls and hand wheels are in easy reach and still not too close."

He's evidently using some other machine tools along with his Garvin equipment and means what he says.

It does us good to hear from folks like that, for living up to an ideal isn't worth much if the ideal isn't a practical success.

We've always aimed to build the most serviceable machine tools—and are going to keep right on.

A. R. Garvin.

Look Beyond the Machine At the Work It Produces

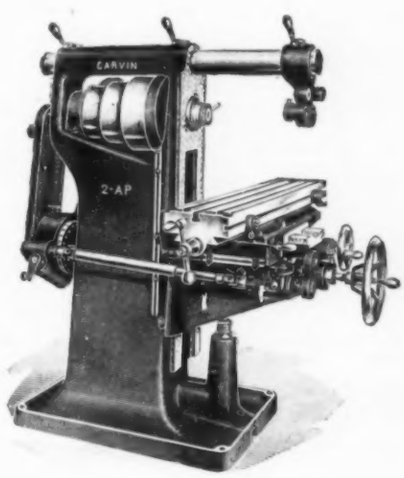
You wouldn't buy an automobile because the trimmings were all nickel-plated and the paint of a special gloss—those things wear off too soon. It's "miles to the gallon" and "ease on tires" that counts—performance.

That's what it ought to be with milling machines. And performance is not the easiest thing to deliver. It has to be built into a machine, not splashed on the surface.

Garvin Milling Machines belong to that class of machinery whose purpose in being is to produce work. They are built solely for that—hard work, at high speed, and long continued runs. Every part of design, every step in manufacture, combine to produce a machine that will live up to this work-producing requirement.

Have you given Garvin Milling Machines a chance to set the pace in your plant?

Built for practically every milling duty—a wide choice from which to pick just the machine you need. Descriptive circulars on request.



No. 2A—Plain Milling Machine

The Garvin Machine Co.

Spring and Varick Streets, New York, N. Y.

G-79

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Euclid Crane & Hoist Co., Euclid
Link-Belt Co., Chicago, Philadelphia
Niles-Bement-Pond Co., N. Y.
Northern Eng. Works, Detroit.
Pawling & Harnischfeger Co., Milwaukee.
Shepard Elec. C. & H. Co., Montour Falls.
Yale & Towne Mfg. Co., Stamford.

Hoists, Hand
Canton F. & M. Co., Canton.
Chisholm-Moore Mfg. Co., Cleveland
Ford Chain Block & Mfg. Co., Phila.
Harrington Son & Co., Phila.
Reading Chain Block Co., Reading.
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Independent Pneu. Tool Co., Chicago.
Ingersoll-Rand Co., N. Y.
Waiting Corporation, Harvey
Worthington P. & M. Corp., N. Y.

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Independent Pneu. Tool Co., Chicago.

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Schieren Co., Chas A., N. Y.

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Watson-Stillman Co., N. Y.
Worthington P. & M. Corp., N. Y.

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Starrett Co., L. S., Athol.

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Jacks, Planer
Armstrong Bros. Tool Co., Chicago.

Japans
Hilo Varnish Corp., Brooklyn.

Jigs and Fixtures (See Contract Work)

Kettles, Soda
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Manufacturing Equip. & Eng. Co., Farmingham.

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Baker Bros., Toledo
Davis Mch. T. Co., Rochester
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Mitts & Merrill, Saginaw
Morton Mfg. Co., Muskegon Heights.
National Mach. Tool Co., Cincinnati.
Newton Mach. Tool Wks., Phila
Niles-Bement-Pond Co., N. Y.

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Moltrup Steel Products Co., Beaver Falls
Morton Mfg. Co., Muskegon Heights.
Whitney Mfg. Co., Hartford.
Williams & Co., J. H., Brooklyn.

Knurl Holders
Graham Mfg. Co., Providence.
Williams & Co., J. H., Brooklyn.

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McCrosky Tool Corp., Meadville, Pa.

Lamps, Electric
Cooper-Hewitt Elect. Co., Hoboken

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Rivett Lathe & Grinder Co., Boston
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New Britain Mach. Co., New Britain.

Lathe Tools
Armstrong Bros. Tool Co., Chicago
Gisholt Machine Co., Madison, Wis.
Lovejoy Tool Co., Springfield.
Williams & Co., J. H., Brooklyn

Lathes, Automatic and Semi-Automatic
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Jones & Lamson Mach. Co., Springfield, Vt.
National Acme Co., Windsor, Vt.
Potter & Johnston Mach. Co., Pawtucket.
Reed-Prentice Co., Worcester
Steinle Turret Mach. Co., Madison.
Wood Turret Mach. Co., Brazil, Ind.

Lathes, Bench
Ames Co., B. C., Waltham, Mass.
Blount Co., J. G., Everett, Mass.
Dalton Mfg. Corp., N. Y.
Diamond Machine Co., Providence
Elgin Tool Works, Elgin, Ill.
Hjorth Lathe & T. Co., Boston.
National Premier Mch. Co., Cleveland
Oliver Mfg. Co., Buffalo
Potter Tool & Mch. Wks., N. Y.
Pratt & Whitney Co., Hartford
Rivett Lathe & Grinder Co., Boston
Russell, Holbrook & Henderson, N.Y.
Seneca Falls Mfg. Co., Seneca Falls,
Sloan & Chace Mfg. Co., Newark.
South Bend Lathe Wks., South Bend.
Stark Tool Co., Waltham
Van Norman M. T. Co., Springfield.
Wade-American Precision Tool Co., Waltham

Lathes, Boring
Gisholt Machine Co., Madison
Niles-Bement-Pond Co., N. Y.
Potter & Johnston Mach. Co., Pawtucket.

Lathes, Chucking (See Lathes, Horizontal Turret)

Lathes, Engine
American Tool Wks. Co., Cincinnati.
Axelson Mach. Co., Los Angeles
Barnes Co., W. F. & John, Rockford
Barnes Drill Co., Inc., Rockford
Blount Co., J. G., Everett, Mass.
Boye & Emmes Mach. Tool Co., Cincinnati
Bradford Mach. Tool Co., Cincinnati
Champion Tool Wks. Co., Cincinnati.
Cincinnati L. & T. Co., Cincinnati
Dalton Mfg. Corp., N. Y.
Davis Mch. T. Co., Rochester
Fairbanks Co., N. Y.
Fitchburg Mach. Wks., Fitchburg
Flather & Co., Nashua
Gisholt Machine Co., Madison, Wis.
Greaves, Klusman Tool Co., Cincinnati
Greaves Mach. Tool Co., Cincinnati
Hendey Machine Co., Torrington
Hill Clark & Co., Boston
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Lodge & Shipley Mach. Tool Co., Cincinnati
Manning, Maxwell & Moore, N. Y.
Monarch Mach. Tool Co., Sidney, O.
Morris Mach. Tool Co., Cincinnati
Mueller Mach. Tool Co., Cincinnati
Niles-Bement-Pond Co N. Y.
Pittsburgh Mach. T. Co., Braddock.
Prentiss & Co., Henry, N. Y.
Reed-Prentice Co., Worcester
Rockford (Ill.) Lathe & D. Co.
Rockford (Ill.) Tool Co.
Russell, Holbrook & Henderson, N.Y.
Ryerson & Son, Joseph T., Chicago
Seneca Falls Mfg. Co., Seneca Falls
Sidney Mach. Tool Co., Sidney, O.
South Bend Lathe Wks., South Bend
Springfield Mach. Tool Co., Springfield, O.
Strong, Carlisle & Hammond Co., Cleveland
Whitcomb-Blaisdell M. T. Co., Worcester
Wickes Bros., Saginaw

Lathes, Extension and Gap
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Barnes Drill Co., Rockford, Ill.
Harrington, Son & Co., Phila.
Manning, Maxwell & Moore, N. Y.
Niles-Bement-Pond Co., N. Y.
Ryerson & Son, Joseph T., Chicago

Lathes, Foot Power
Barnes Co., W. F. & John, Rockford,
Dalton Mfg. Corp., N. Y.
Seneca Falls Mfg. Co., Seneca Falls

Lathes, Horizontal Turret
Acme Mach. Tool Co., Cincinnati
Dreses Mach. Tool Co., Cincinnati
Foster Mach. Co., Elkhart
Gisholt Mach. Co., Madison
International Mach. Tool Co., Indianapolis
Jones & Lamson Mach. Co., Springfield, Vt.
New Britain Mach. Co., New Britain
Pratt & Witney Co., Hartford.
Reed-Prentice Co., Worcester
Steinle Turret Mach. Co., Madison
Warner & Swasey Co., Cleveland.
Wood Turret Mach. Co., Brazil, Ind.

Lathes, Polishing (See Polishing and Buffing)

Lathes, Speed and Hand
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Diamond Machine Co., Providence
Garvin Mach. Co., N. Y.
Seneca Falls Mfg. Co., Seneca Falls

Lathes, Threading
Automatic Mach. Co., Bridgeport
Rivett Lathe & Grinder Co., Boston
Sloan & Chace Mfg. Co., Newark.

Lathes, Vertical Turret
Bullard Mach. Tool Co., Bridgeport

Lathes, Wood Turning
Barnes Co., W. F. & John, Rockford.
Blount Co., J. B., Everett.
Seneca Falls Mfg. Co., Seneca Falls

Letters and Figures
Brown & Sharpe Mfg. Co., Providence
Hoggson & Pettis Mfg. Co., New Haven
Pannier Bros. Stamp Co., Pittsburgh

Lighting Fixtures
McCrosky Tool Corp., Meadville.
Miller Saw Trimmer Co., Pittsburgh

Lockers, Clothes
Manufacturers Equip. & Eng. Co., Framingham.

Lubricants
Fiske Bros. Ref. Co., N. Y.
Oakley Chemical Co., N. Y.
Royersford Fdry. & Mach. Co., Royersford
Sun Co., Philadelphia
Texas Co., N. Y.
White & Bagley Co., Worcester

Machinists' Small Tools
Armstrong Bros. Tool Co., Chicago.
Athol Mach. Co., Athol
Browne & Sharpe Mfg. Co., Providence
Fairbanks Co., N. Y.
Grover File Co., Nashua, N. H.
Keystone Reamer & T. Co., Millersburg, Pa.
Pratt & Whitney Co., Hartford.
Randall & Stickney, Waltham
Starrett Co., L. S., Athol.
Taft-Peirce Mfg. Co., Woonsocket
Williams & Co., J. H., Brooklyn

Mandrels, Expanding
Browne & Sharpe Mfg. Co., Providence.
Cochrane-Bly Co., Rochester.
Nicholson & Co., W. H., Wilkes-Barre.

Mandrels, Solid
Brown & Sharpe Mfg. Co., Providence.
Lincoln Twist Drill Co., Taunton.
National Twist D. & T. Co., Detroit
Nicholson & Co., W. H., Wilkes-Barre

Marking Devices (See Stamps, Steel)

Marking Machines
Engravers & Printers Mch. Co., Sag Harbor.
Noble & Westbrook Mfg. Co., Hartford.

Measuring Machines
Norma Co. of America, N. Y.
Pratt & Whitney Co., Hartford.
Taft-Peirce Mfg. Co., Woonsocket.

Metal Cleaning Equipment
Pangborn Corp., Hagerstown, Md.

Metal Finishes
Hilo Varnish Corp., Brooklyn

Metals, Alloy
International Nickel Co., N. Y.

Micrometer Calipers
Almond Mfg. Co., T. R., Ashburnham.
Browne & Sharpe Mfg. Co., Providence.
Randall & Stickney, Waltham
Starrett Co., L. S., Athol.

Milling Attachments
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Becker Milling Mch. Co., Hype Park.
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Fox Mach. Co., Jackson, Mich.
Garvin Mach. Co., N. Y.
Hendy Mach. Co., Torrington, Ct.
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Kearney & Trecker Co., Milwaukee
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Oesterlein Machine Co., Cincinnati.
Potter & Johnston Mach. Co., Pawtucket
Sloan & Chace Mfg. Co., Newark.
Standard Eng. Wks., Pawtucket
Taft-Peirce Mfg. Co., Woonsocket
Whiting & Comstock, Hartford.

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Brown & Sharpe Mfg. Co., Providence.
Cincinnati (O.) Milling Mach. Co.
Pratt & Whitney Co., Hartford.
Toledo Milling Mach. Co., Toledo.

Milling Machines Bench
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Burke Mch. T. Co., Conneaut
Carter & Hakes Mach. Co., Winsted
Pratt & Whitney Co., Hartford.
Sloan & Chace Mfg. Co., Newark.
Stark Tool Co., Waltham.
Van Norman M. T. Co., Springfield.

Milling Mch., Duplex
Knight Mchy. Co., W. B., St. Louis.

Milling Machines, Hand
Becker Milling Mch. Co., Hyde Park.
Brown & Sharpe Mfg. Co., Providence
Burke Mch. T. Co., Conneaut
Carter & Hakes Mach. Co., Winsted.
Cincinnati (O.) Milling Mach. Co.
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Garvin Mach. Co., N. Y.
Pratt & Whitney Co., Hartford.
Standard Eng. Wks., Pawtucket.
Van Norman M. T. Co., Springfield.
Whitney Mfg. Co., Hartford.
Wisconsin Miller Mfg. Co., Milwaukee.

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Beaman & Smith Co., Providence
Betts Mach. Co., Rochester.
Ingersoll Milling Mch. Co., Rockford
Newton Mach. Tool Wks., Phila.
Niles-Bement-Pond Co., N. Y.

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Betts Mach. Co., Rochester
Bilton Mach. Tool Co., Bridgeport
Browne & Sharpe Mfg. Co., Providence
Chicago Mach. Tool Co., Chicago
Cincinnati (O.) Milling Mach. Co.
Cochrane-Bly Co., Rochester.
Fox Mach. Co., Jackson, Mich.
Garvin Mach. Co., N. Y.
Gooley & Edlund, Cortland, N. Y.
Hendey Mach. Co., Torrington, Ct.
Ingersoll Milling Mch. Co., Rockford
Kearney & Trecker Co., Milwaukee
Kempsmith Mfg. Co., Milwaukee
LeBlond Mach. Tool Co., R. K., Cincinnati
Manning, Maxwell & Moore, N. Y.
Oesterlein Mach. Co., Cincinnati
Potter & Johnston Mach. Co., Pawtucket
Rockford (Ill.) Milling Mch. Co.
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"Magic" Chucks

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To Change Small Tools

"MAGIC" CHUCK **4 Operations**

Common Drill Chuck With M. T. Sleeve **13 Operations**

Cost of a machine made product is mostly labor (T-I-M-E). You can appreciate the reduction in cost incident to reducing 13 operations to 4.

Tests with a stop watch have shown that the time required for changes with a "Magic" Chuck averages about 1/6 the time of changes with the common drill chuck.

So where frequent changes of small tools are necessary the economy is evident. A little investigation will bring real appreciation.

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Foster Mach. Co., Elkhart
Gisholt Machine Co., Madison
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Pratt & Whitney Co., Hartford
Waltham Mach. Wks., Waltham

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Oesterlein Machine Co., Cincinnati
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Ryerson & Son, Joseph T., Chicago
Van Norman M. T. Co., Springfield.

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Kearney & Trecker Co., Milwaukee.
Knight Mchy. Co., W. B., St. Louis
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Newton Mach. Tool Wks., Phila.
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Van Norman Mach. T. Co., Springfield.

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Lees-Bradner Co., Cleveland
Newton Mach. Tool Wks., Phila.
Waltham Mach. Wks., Waltham

Milling Tools, Adjustable, Hollow
Geometric Tool Co., New Haven

Monel Metal
International Nickel Co., N. Y.

Motors, Electric
Crocker-Wheeler Co., Ampere, N. J.
Wisconsin Electric Co., Racine

Nickel
International Nickel Co., N. Y.

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Cutter & Wood Supply Co., Boston

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Gits Bros. Mfg. Co., Chicago
Tucker, W. A. & C. F., Hartford

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National Mach. Tool Co., Cincinnati

Oil Stones
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Oils
Fiske Bros. Ref. Co., N. Y.
Sun Co., Philadelphia
Texas Co., N. Y.
Tolhurst Mch. Wks., Troy
White & Bagley Co., Worcester

Oils, Soluable
Fiske Bros. Ref. Co., N. Y.

Oxygen
Davis-Bournonville Co., Jersey City

Packing, Hydraulic
Chicago Rawhide Mfg. Co., Chicago
Graton & Knight Mfg. Co., Worcester
Schieren Co., Chas. A., N. Y.

Paints, Machinery
Hilo Varnish Corp., Brooklyn

Pattern Shop Machinery (See Woodworking Machinery)

Patterns, Wood and Metal
Mehl Mach. Tool & Die Co., Roselle.
Modern Mach. & Pattern Co., Terra Haute

Pipe Bending Machines
Underwood Corp., H. B., Phila.

Pipe Cutting and Threading Machines
Bignall & Keeler Mach. Wks., Edwardsville.
Curtis & Curtis Co., Bridgeport
Etna Mach. Co., Toledo
Harrington Son & Co., Edwin, Phila.
Landis Mach. Co., Waynesboro
Manning, Maxwell & Moore, N. Y.
Merrell Mfg. Co., Toledo
Murchey Mach. & Tool Co., Detroit
Saunders Sons, D., Yonkers
Standard Tool Co., Cleveland
Standard Eng. Wks., Ellwood City
Trimont Mfg. Co., Roxbury

Pipe Fitters' Tools
Butterfield & Co., Derby Line, Vt.
Saunders Sons, D., Yonkers
Trimont Mfg. Co., Roxbury
Williams & Co., J. H., Brooklyn

Piston-Ring Machines
National Acme Co., Windsor, Vt.
Persons-Arter Mach. Co., Worcester
Potter & Johnston Mach. Co., Pawtucket
Pratt & Whitney Co., Hartford
Planer Machine Knives
Atkins & Co., E. C., Indianapolis

Planer Parallels
Taft-Peirce Mfg. Co., Woonsocket

Planing Machines
American Tool Wks. Co., Cincinnati
Betts Machine Co., Rochester
Cincinnati Planer Co., Cincinnati
Gray Co., G. A., Cincinnati
Lynd, Farquhar Co., Boston
Manning, Maxwell & Moore, N. Y.
Newton Mach. Tool Wks., Phila.
Niles-Bement-Pond Co., N. Y.
Ohio Mach. Tool Co., Kenton, O.
Prentiss & Co., Henry, N. Y.
Russell, Holbrook & Henderson, N.Y.
Ryerson & Son, Joseph T., Chicago
Sellers & Co., Wm., Philadelphia
Strong, Carlisle & Hammond Co., Cleveland
Whitcomb-Blaisdell Mch. Tool Co., Worcester

Planing Machines, Rotary
Cleveland (O.) Punch & Shear Wks.
Niles-Bement-Pond Co., N. Y.
Underwood Corp., H. B., Phila.

Plate Rolls
Cleveland (O.) Punch & Shear Wks.
Hilles & Jones Co., Wilmington, Del.
Niles-Bement-Pond Co., N. Y.

Pneumatic Tools
Cleveland (O.) Pneumatic Tool Co.
Anderson Bros. Mfg. Co., Rockford
Chicago Pneu. Tool Co., N. Y.
Independent Pneu. T. Co., Chicago.
Ingersoll-Rand Co., N. Y.

Polishing and Buffing Machines
Barnes Co., W. F. & John, Rockford
Blanchard Mach. Co., Cambridge
Blount Co., J. G., Everett
Bryant Chuck Grinder Co., Springfield, Vt.
Brown & Sharpe Mfg. Co., Providence
Builders Iron Fdry., Providence
Cutter & Wood Supply Co., Boston
Diamond Mach. Co., Providence
Fitchburg Grind. Mch. Co., Fitchburg
Gardner Mach. Co., Beloit
Greenfield Mach. Co., Greenfield
Hammond Mfg. Co., Cleveland
Heald Mach. Co., Worcester
Independent Pneu. Tool Co., Chicago
Keller Pneu. T. Co., Grand Haven
Landis Tool Co., Waynesboro
New Britain Mach. Co., New Britain
Newton Mach. Tool Wks., Phila.
Noble & Westbrook Mfg. Co., Hartford
Norton Co., Worcester
Potter Tool & Mach. Wks., N. Y.
Rivett Lathe & Grinder Co., Boston
Rowbottom Mach. Co., Waterbury
Royersford Fdry. & Mach. Co., Royersford
Safety Emery Wheel Co., Springfield
Union Twist Drill Co., Athol
U. S. Electrical Tool Co., Cincinnati
Universal Grind. Mach. Co., Fitchburg
Van Norman Mch. T. Co., Springfield, Mass.
Wilmarth & Morman Co., Grand Rapids
Wisconsin Electric Co., Racine

Pressed Steel Parts
Acklin Stamp. Co., Toledo
New Britain Mach. Co., New Britain.
Worcester Pressed S. Co., Worcester

Presses, Arbor
Atlas Press Co., Kalamazoo
Barnes Co., W. F. & John, Rockford
Metalwood Mfg. Co., Detroit
Nicholson Co., W. H., Wilkes-Barre
Wilmarth & Morman Co., Grand Rapids

Presses, Banding
Metalwood Mfg. Co., Detroit

Presses, Broaching
Atlas Press Co., Kalamazoo
Metalwood Mfg. Co., Detroit

Presses, Drop and Forging
Ams Mch. Co., Max, N. Y.
Bliss Co., E. W., Brooklyn
Elmes Eng. Wks., Chas. F., Chicago
Niles-Bement-Pond Co., N. Y.
Toledo Mach. & Tool Co., Toledo

Presses, Foot and Hand
Atlas Press Co., Kalamazoo
Bliss Co., E. W., Brooklyn
Ferracute Mach. Co., Bridgeton, N. J.
Shuster Co., F. B., New Haven
Taylor & Fenn Co., Hartford

Presses, Forcing
Ams Mch. Co., Max, N. Y.
Atlas Press Co., Kalamazoo
Barnes Co., W. F. & John, Rockford
Hydraulic Press Mfg. Co., Mt. Gilead
Lucas Mach. Tool Co., Cleveland
Metalwood Mfg. Co., Detroit
Presses, Hydraulic
Elmes Eng. Wks., Chas. F., Chicago
Hylraulic Press Mfg. Co., Mt. Gilead
Metalwood Mfg. Co., Detroit
Niles-Bement-Pond Co., N. Y.
Watson-Stillman Co., N. Y.

Presses, Power
Ams Mch. Co., Max, N. Y.
Barnes Co., W. F. & John, Rockford
Bliss Co., E. W., Brooklyn
Ferracute Mach. Co., Bridgeton, N. J.
Niagara M. & T. Works, Buffalo
Rowbottom Mach. Co., Waterbury
Stoll Co., D. H., Buffalo
Toledo Mach. & Tool Co., Toledo
V. & O. Press Co., Glendale, N. Y.

Presses, Screw
Barnes Co., W. F. & John, Rockford
Bliss Co., E. W., Brooklyn

Profiling Machines
Becker Milling Mch. Co., Hyde Park.
Cochrane-Bly Co., Rochester
Garvin Mach. Co., N. Y.
Newton Mach. Tool Wks., Phila.
Pratt & Whitney Co., Hartford.
Stark Tool Co., Waltham
Wade-American Precision Tool Co., Waltham

Pulley Turning and Boring Machines
American Tool Wks. Co., Cincinnati
Avey Drilling Mach. Co., Cincinnati
Niles-Bement-Pond Co., N. Y.
Wilmarth & Morman Co., Grand Rapids

Pulleys, Cork Insert
American Pulley Co., Philadelphia

Pulleys Metal
American Pulley Co., Philadelphia
Brown Co., A. & F., N. Y.
Brown & Sharpe Mfg. Co., Providence
Caldwell & Son Co., H. W., Chicago
Johnson Mach. Co., Carlyle, Manchester.
Transmission Ball Bearing Co., Buffalo
Wilmarth & Morman Co., Grand Rapids

Pulleys, Paper
Rockwood Mfg. Co., Indianapolis

Pumps, Hydraulic
Elms Eng. Wks., Chas F., Chicago
Hydraulic Press Mfg. Co., Mt. Gilead
Metalwood Mfg. Co., Detroit
Wilmarth & Morman Co., Grand Rapids
Worthington P. & M. Co., N. Y.

Pumps, Lubricant and Oil
Brown & Sharpe Mfg. Co., Providence
Gilbert & Barker Mfg. Co., Springfield, Mass.
Trahern Pump Div., Geo. D. Roper Corp., Rockford.
Worthington P. & M. Co., N. Y.

Pumps, Power
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Fairbanks Co., N. Y.
Ingersoll-Rand Co., N. Y.
Trahern Pump Div., Geo. D. Roper Corp., Rockford.
Worthington P. & M. Co., N. Y.

Punches, Center
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol.

Punches, Hand
Armstrong-Blum Mfg. Co., Chicago.

Punches, Power
Birdsboro Steel F. & M. Co., Birdsboro.
Cleveland (O.) Punch & Shear Wks.
Ferracute Mach. Co., Bridgeton
Hilles & Jones Co., Wilmington, Del.
Mitts & Merrill, Saginaw
Prentiss & Co., N. Y.
Royersford Fdry. & Mach. Co., Royersford
Ryerson & Sons, Joseph T., Chicago
Watson-Stillman Co., N. Y.

Pyrometers, Electric
Bristol Co., Waterbury.
Brown Instrument Co., Philadelphia.
Engelhard Chas., N. Y.
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Gould & Eberhardt, Newark, N. J.
Sloan & Chace Mfg. Co., Newark.

Racks, Storage (See Furniture, Machine Shop)

Racks, Cut
Moltrup Steel Products Co., Beaver Falls

Radiators, Japanning Oven
American Gas Furnace Co., N. Y.
Chicago Flexible Shaft Co., Chicago.

Rammers, Foundry
Brown & Sharpe Mfg. Co., Providence.
Chicago Pneumatic Tool Co., N. Y.
Ingersoll-Rand Co., N. Y.

Rawhide, Rope
Schieren Co., Chas. A., N. Y.

Reamer Holders
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Brubaker & Bros., W. L., N. Y.
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Gisholt Machine Co., Madison.
Keystone R. & T. Co., Millersburg
McCrosky Tool Corp., Meadville, Pa.
New Britain T. & M. Co., New Britain

Reamers, Solid
Bennett Tool Co., Wrentham
Brubaker & Bros., W. L., N. Y.
Buckeye Twist Drill Co., Alliance.
Butterfield & Co., Derby Line, Vt.
Clark Equipment Co., Buchanan.
Detroit Twist Drill Co., Detroit
Gammon Holman Co., Manchester
Kelly Reamer Co., Cleveland.
Keystone R. & T. Co., Millersburg
Lincoln Twist Drill Co., Taunton.
Morse Twist D. & M. Co., New Bedford.
National Tool Co., Cleveland.
National Twist D. & T. Co., Detroit
Reed Mfg. Co., Erie.
Rich Tool Co., Chicago.
Taft-Peirce Mfg. Co., Woonsocket
Union Twist Drill Co., Athol.
Whitman & Barnes Mfg. Co., Akron

Reamers, Taper
Bennett Tool Co., Wrentham
Brown & Sharpe Mfg. Co., Providence.
Gammon-Holman Co., Manchester
Keystone R. & T. Co., Millersburg
Lincoln Twist Drill Co., Taunton.

Recorders, Pressure
Bristol Co., Waterbury.
Brown Instrument Co., Philadelphia.

Recorders, Temperature
Bristol Co., Waterbury.

Recorders, Time
Gisholt Machine Co., Madison.

Resistance Materials
Driver-Harris Co., Harrison, N. J.

Rivet Making Machinery
Cook Co., Asa S., Hartford.
National Machinery Co., Tiffin.

Riveting Machines
Bilton Mach. Tool Co., Bridgeport
Birdsboro Steel F. & M Co., Birdsboro.
Chicago Pneumatic Tool Co., N. Y.
Grant Mfg. & Mach. Co., Bridgeport
Independent Pneu. Tool Co., Chicago
Ingersoll-Rand Co., N. Y.
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Thomson Spot Welder Co., Lynn.
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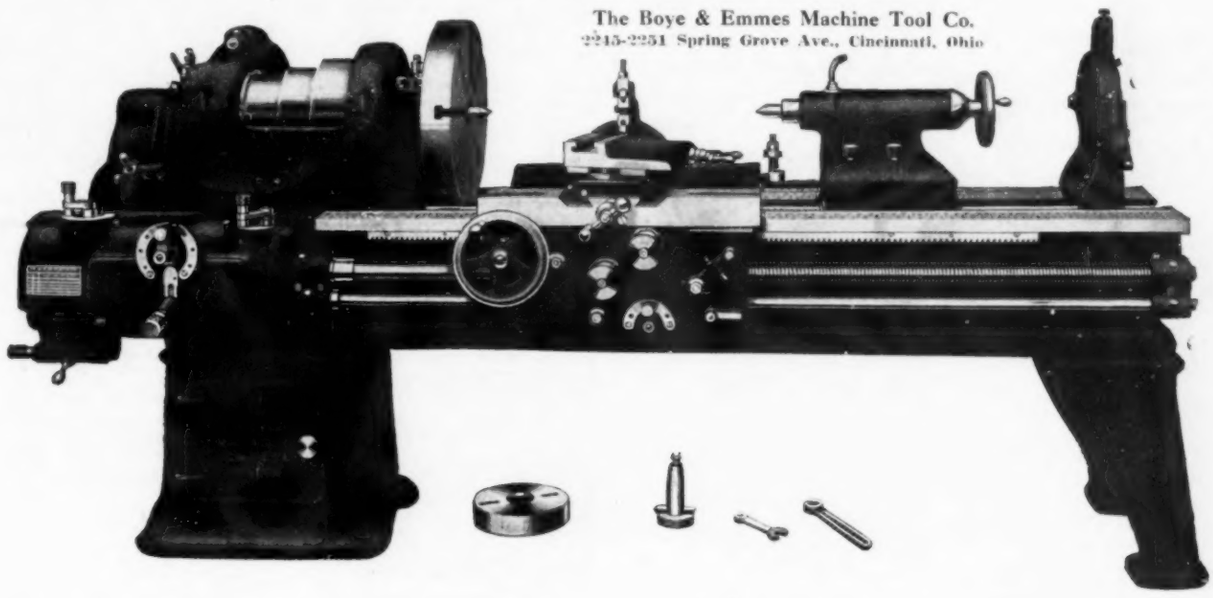

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West Haven Mfg. Co., New Haven.

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Baker Bros., Toledo.

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Scales
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Scraping Tables
New Britain Mach. Co., New Britain

Screw-Machine Work
Ansonia Mfg. Co., Ansonia.
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Tock Screw Mch. Products Corp., L. I. City.
Whiting & Com-stock, Hartford.

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Cook Co., Asa., S., Hartford.
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Davenport Mch. T. Co., Rochester
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Warner & Swasey Co., Cleveland.
Wood Turret Mach. Co., Brazil, Ind.

Screw Plates
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Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield.
Gardner Bryan Co., Cleveland
Morse Twist D. & M. Co., New Bedford.

Screws, Cap and Set
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Bristol Co., Waterbury
National Acme Co., Cleveland.
Strong, Carlisle & Hammond Co., Cleveland.

Screws, Machine
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Second-Hand Machinery (See Searchlight Section)
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Beal & Co., Joseph, Boston
Botwinik Bros., New Haven
Brownell Mchy. Co., Providence.
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Morris Mchy. Co., Newark
Motch & Merryweather Mchy. Co., Cleveland.
National Pipe & Supply Co., Philadelphia
Nemirovsky & Son, S., Philadelphia
N. Y. Mchy. Ex., N. Y.
Niles & Co., F. H., N. Y.
Niles-Bement-Pond Co., N. Y.
Norton-Broadway Mchy. Co., Cincinnati
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Simmons Mach. Co., N. Y.
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Warner Co., H. D., Hartford.
Wayne Mchy. Co., Ft. Wayne.
Winterer, H. L., Philadelphia.

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Strand & Co., N. A., Chicago.
Union Drawn Steel Co., Beaver Falls

Shapes, Cold-Drawn Special Steel
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Shaping Machines
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Hilles & Jones Co., Wilmington, Del.
Mitts & Merrill, Saginaw
Niagara Mach. & Tool Wks., Buffalo.
Royersford Fdry. & Mach. Co., Royersford
Stoll Co., D. H., Buffalo.
Toledo Mach. & Tool Co., Toledo.

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Bliss Co., E. W., Brooklyn
Ferracute Mach. Co., Bridgeton, N. J.
Niagara Mach. & Tool Wks., Buffalo
Savage Co., W. J., Knoxville.
Toledo Mach. & Tool Co., Toledo.

Shelving, Steel (See Furniture, Machine Shop)

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Laminated Shim Co., N. Y.

Slotting Machines
Betts Mach. Co., Rochester.
Cochrane-Bly Co., Rochester.
Dill Mach. Co., T. C., Phila.
Garvin Mach. Co., N. Y.
National Acme Co., Cleveland.
Newton Mach. Tool Wks., Phila.
Sellers & Co., Wm., Phila.

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Clark Equip. Co., Buchanan, Mich.
Detroit Twist Drill Co., Detroit
Lincoln Twist Drill Co., Taunton.
Pratt & Whitney Co., Hartford.

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Bilgram Mach. Wks., Phila.
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Link-Belt Co., Chicago, Phila.
Meisel Press Mfg. Co., Boston.
Morse Chain Co., Ithaca.
Philadelphia Gear Works, Phila.
Whitney Mfg. Co., Hartford.

Squares
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol.

Shafting
Stampings, Metal
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American Pulley Co., Phila.
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Detroit Stamp. Co., Detroit.
Gem Mfg. Co., Pittsburgh.
Kales Stamp. Co., Detroit.
New Britain Mach. Co., New Britain
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Root Co., C. J., Bristol, Ct.
Worcester Pressed S. Co., Worcester

Stamps, Steel
Hoggson & Pettis Mfg. Co., New Haven.
Matthews & Co., Jas. H., Pittsburgh
Noble & Westbrook Mfg. Co., Hartford.
Pannier Bros. Stamp Co., Pittsburgh

Stanchions, Machine Guard and Guard Rail
New Britain Mach. Co., New Britain
Stands, Portable (See Furniture, Machine Shop)

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Dart Mfg. Co., E. M., Providence.

Steel, Cold Rolled Strip
Blum & Co., Julius, N. Y.
Cyclops Steel Co., N. Y.
Hawkridge Bros. Co., Boston.

Steel Hardness Measuring and Treating Instruments
Shore Instrument & Mfg. Co., N. Y.

Steel Scrap Reclamation
Onondaga Steel Co., Syracuse.

Steel Shafting and Free Cutting Screw
Blum & Co., Julius, N. Y.
Columbia Steel & Shaft. Co., Pittsburgh.
Cyclops Steel Co., N. Y.
Hawkridge Bros. Co., Boston.
Moltrup Steel Products Co., Beaver Falls
New England D. Steel Co., Mansfield
Union Drawn Steel Co., Beaver Falls.

Steel, Sheet
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Illingsworth Steel Co., John, N. Y.
Jessop & Sons, Wm., N. Y.
Wards Son, Edgar T., Boston

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Armstrong Bros. Tool Co., Chicago.
Buffalo Forge Co., Buffalo.
Cleveland (O) Twist Drill Co.
Cyclops Steel Co., N. Y.
Federal Tool & Alloy S. Corp., N. Y.
Firth-Sterling Steel Co., McKeesport
Halcomb Steel Co., Syracuse.
Hawkridge Bros. Co., Boston.
Illingsworth Steel Co., John, N. Y.
Jessop & Sons, Wm., N. Y.
Ludlum Steel Co., Watervliet
Onondaga Steel Co., Inc., Syracuse.
Vanadium-Alloys Steel Co., Pittsburgh.
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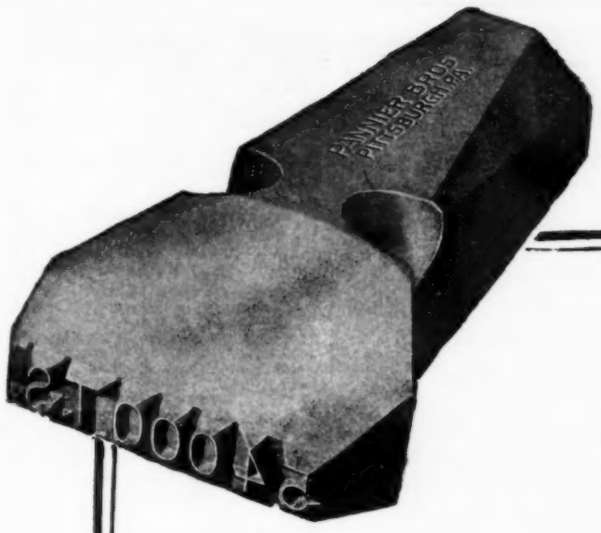

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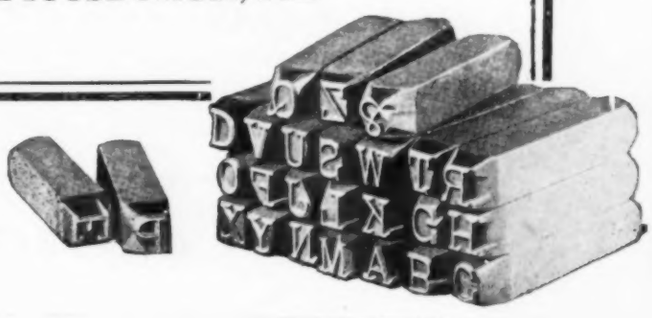

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